Breeding Landbird Monitoring Protocol Narrative

Contents

1. Protocol Narrative
- 1.1 Background and Objectives
  - 1.1.1 Introduction
  - 1.1.2 Monitoring Objectives
- 1.2 Sampling Design
  - 1.2.1 Introduction
  - 1.2.2 Site Selection
  - 1.2.3 Population Being Monitored
  - 1.2.4 Sampling Frequency and Replication
  - 1.2.5 Power of Monitoring Protocol to Detect Change
- 1.3 Field Methods
  - 1.3.1 Field Schedule and Preparations
  - 1.3.2 Sampling Methods
- 1.4 Data Management
  - 1.4.1 Overview of Database Design
  - 1.4.2 Data Entry and Verification
- 1.5 Data Analysis
  - 1.5.1 Data Summaries and Statistical Analysis
- 1.6 Data Reporting
  - 1.6.1 Ecological Integrity Assessment and Scorecard
  - 1.6.2 General Reporting Requirements
- 1.7 Literature Cited

2. Standard Operating Procedures (SOPs) for NETN Breeding Bird Monitoring
- SOP 1. Field Season Logistics
- SOP 2. Recruiting and Training Observers
- SOP 3. Establishing and Marking Sampling Points
- SOP 4. Conducting Point Counts
- SOP 5. Data Management (in prep)
- SOP 6. Data Analysis (in prep)
- SOP 7. Data Reporting (in prep)

Appendix I. List of potential species for each NETN park/BCR, and their PIF Continental and/or Regional Importance Rank, and Conservation Action Priority

Appendix II. Species assignments in the 12 response guilds included in the biotic integrity scorecard.

1. PROTOCOL NARRATIVE

1.1 Background and Objectives

1.1.1 Introduction

Birds are an important component of park ecosystems, and their high body temperature, rapid metabolism, and high ecological position in most food webs make them a good indicator of local and regional ecosystem change. It has been suggested that management activities aimed at preserving habitat for bird populations, such as for neotropical migrants, can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer 1993). Moreover, among the public, birds are a high profile taxa, and many parks provide information on the status and trends of the park's avian community through their interpretive materials and programs.

In developing comprehensive long-term monitoring plans, landbirds (a general term used to describe relatively small, terrestrial birds, excluding raptors and upland game birds) are among the best taxonomic groups to monitor because: 1) they are the most easily and inexpensively detected and identified vertebrate animals, 2) a single survey method is effective for many species, 3) accounting and managing for many species with different ecological requirements promotes conservation strategies at the landscape scale (Hutto and Young 2002), 4) many reference datasets and standard methods are available (Ralph et al. 1993, 1995), and 5) the response variability is fairly well understood.

In addition, birds are a useful biotic indicator of the effects of habitat fragmentation. Neotropical migrants appear to be particularly vulnerable to forest fragmentation (Robinson and Wilcove 1994, Faaborg et al. 1995, Rosenberg et al. 1999), which increases the prevalence of forest edges, resulting in higher rates of brood parasitism and nest predation within the remaining breeding habitat (Robinson et al. 1995). Forest fragmentation is an ecological stressor that all Northeast Temperate Network (NETN) parks are impacted by due to the relatively small size of the parks and their land use histories. Although the NPS has some management control over fragmentation within the parks, fragmentation outside park boundaries is widespread throughout much of the Northeastern region.

Although the NETN contains 11 parks (including a section of the Appalachian Trail), implementation of landbird monitoring protocols will be limited to the following 8 parks: Acadia NP, ME (ACAD), Marsh-Billings-Rockefeller NHP, VT (MABI), Minute Man NHP, MA (MIMA), Morristown NHP, NJ (MORR), Roosevelt-Vanderbilt NHS, NY (ROVA), Saint-Gaudens NHS, NH (SAGA), Saratoga NHP, NY (SARA), and Weir Farm NHS, CT (WEFA) (Fig. 1). The Massachusetts Audubon Society will continue to monitor birds at the Boston Harbor Islands NPA, while the small size (~3 ha) of Saugus Ironworks NHS precludes any meaningful landbird monitoring program. Seven of these 8 parks are National Historical Parks or Historic Sites, and thus have a primary mandate to maintain historical features, landscapes, or practices. This mandate may have a substantial impact on ecological resources within these parks, as they are frequently managed to maintain early successional habitats, or incorporate agriculture or forestry. Collectively, the 8 parks total approximately 18,500 ha, and contain diverse cultural and natural resources. They range in size from just 25 ha at Weir Farm NHS, located in densely populated Fairfield County, Connecticut, to over 15,800 ha at Maine's Acadia NP.

On a broad scale, all 8 parks are located within the temperate deciduous forest biome, and fall within two avifaunal biomes (the Eastern and Northern Forest) as defined by Partners in Flight (Rich et al. 2004). At a finer scale, the parks range across 4 Bird Conservation Regions (BCRs) (Fig. 1). BCRs, developed by the North American Bird Conservation Initiative (NABCI 2000), are ecologically defined units that provide a consistent spatial framework for bird conservation across North American landscapes. By employing broad scale units that are ecologically meaningful to bird populations, conservation efforts can be tailored to support groups of species throughout the heart of their ranges. BCRs are being used to help assign "conservation priority" scores for bird species. Each BCR has its own unique list of "priority" species ranked by conservation importance according to a standardized set of criteria determined by partners from Mexico, the United States and Canada.

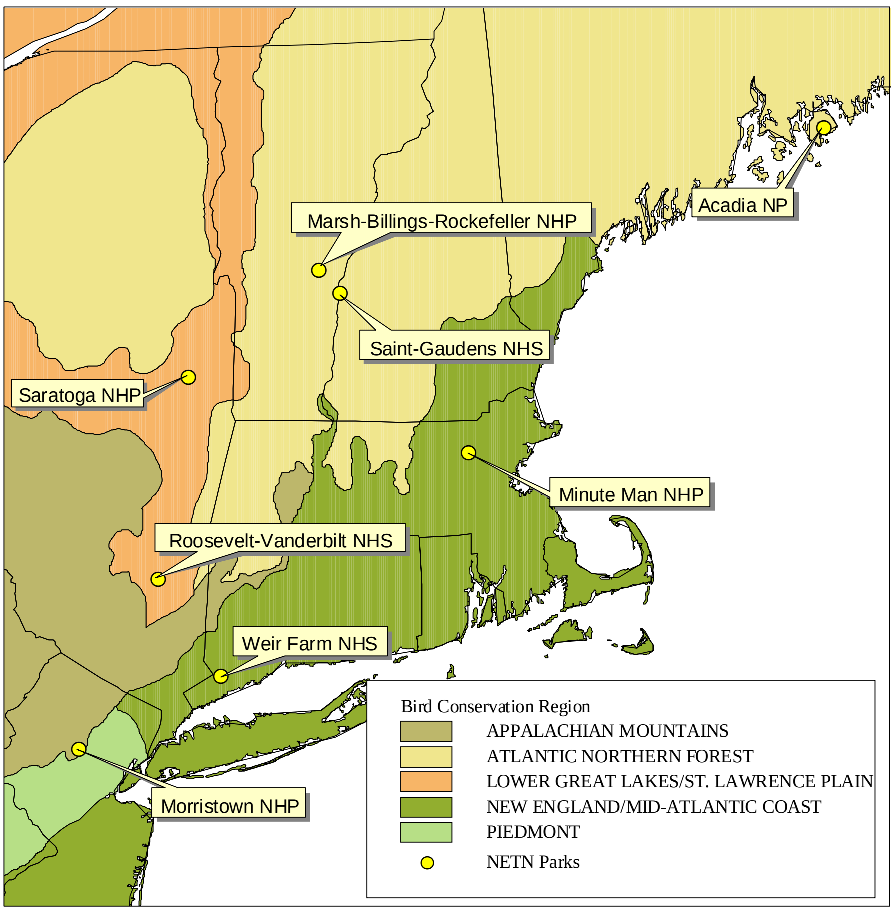


Figure 1. Distribution of NETN Parks where breeding bird monitoring protocols will be implemented and their associated Bird Conservation Regions.

Developing a uniform protocol for monitoring landbirds across the NETN parks will not only provide insights into the long-term trends of avian species composition and relative abundance, but will also provide a measure for assessing the ecological integrity of Northeastern temperate systems. Additionally, monitoring long-term patterns of bird composition and abundance relative to habitat change resulting from a variety of stressors, including deer herbivory, invasive species, fragmentation, and silvicultural practices, will improve our understanding of their effects on bird populations and help guide management actions within NETN parks.

1.1.2 Monitoring Objectives

The overall goals of landbird monitoring are to track the status and trends of breeding landbirds within Network parks because birds are an important natural resource and they are a robust indicator of ecosystem integrity. Breeding landbird monitoring will also support and inform management decisions that may affect avian populations. Additional goals are to increase the visibility of the I&M program and to involve the public with the network's monitoring program. Due to the small size of the majority of the NETN parks, combined with the fact that this is a volunteer-based monitoring program, the power to detect meaningful trends at each park will be limited. However, since NETN landbird monitoring will be partnering with the Vermont Forest Bird Monitoring Program – a regional landbird monitoring project of the Vermont Institute of Natural Science (VINS) initiated in 1989 (see Faccio et al. 1998) – data from some Network parks (MABI, SAGA, and SARA) can be combined with data from 28 Vermont study sites for more powerful estimates of population trends, thus providing an opportunity to make inferences related to changes beyond park boundaries. With that in mind, the protocol described here addresses the following specific, measurable objectives:

Objective 1: Determine annual changes and long-term trends in species composition of native and non-native forest passerine species during the breeding season in 8 NETN parks (listed above). The focus will be on forest and woodland sampling, except at Saratoga, where grasslands will also be sampled

Objective 2: Determine annual changes in relative abundance of:
a) 10 most commonly detected species at each park
b) Combined suite of PIF Priority Species, as determined by BCR

Objective 3: Improve our understanding of breeding bird/habitat relationships and the effects that management actions, such as silvicultural practices and mowing regimes, have on bird populations. We will correlate changes in bird communities with site-specific information about park management activities and with changes in habitat metrics collected at co-located forest condition plots

1.2 Sampling Design

1.2.1 Introduction

Numerous sampling approaches have been used to quantify the status and trends of bird populations, and many different monitoring programs are currently in place throughout North America to determine local, regional, or national trends in bird numbers. Most survey methods allow simultaneous collection of information about species that share a common life history or habitat type, but no single method will adequately sample either the diversity of habitats that birds occupy, or life history groups such as seabirds, songbirds, raptors, and shorebirds.

The sampling design described in this protocol involves a series of sampling stations laid out on a systematic grid that are sampled during 10-minute point counts. For landbirds, point counts are the most widely used quantitative method of monitoring bird populations (Ralph et al. 1995). This technique involves using a standardized methodology to record all birds seen or heard during a fixed amount of time at many widely spaced count locations. Recently, many papers have suggested that unadjusted point counts do not provide accurate estimates of abundance or density (see overview by Thompson 2002) because some birds may not be detected due to: 1) observer variability (experience, hearing); 2) environmental factors (wind, vegetation); and/or 3) physical and behavioral aspects of birds (plumage coloration, singing rate). As a result, several methods have been advocated as a means for incorporating detection probabilities in order to adjust abundance and density estimates derived from point counts. These include distance sampling (Buckland et al. 2001), removal models (Farnsworth 2002), double observer sampling (Nichols et al. 2000), and double sampling (Bart and Earnst 2002). However, because double sampling and double observer sampling are both labor intensive, use of either methodology in a large-scale volunteer-based bird monitoring program would result in significantly reduced sample sizes. In addition, removal models present problems because the assumption of equal probability of detection throughout a 10-minute count is rarely met (Mitchell and Donovan, in prep). The use of distance sampling appears to be the best method of calculating detection probabilities for purposes of avian monitoring in NETN Parks, but we will collect data in a way that also allows for removal modeling.

In distance sampling, the horizontal distance from the observer is estimated for each bird seen or heard during the count period. However, accurately estimating distance is difficult when neither the bird nor its location can be seen, which is common in forested habitats of the Northeast. Although training and experience helps, the volume of sound produced by a singing bird is highly variable, and can be dramatically affected by the bird's singing position, as well as site-specific characteristics including vegetation density and topography. Thus, training at one or a few locations may lead to more accurate distance estimates at those sites, but not at others (Bart et al. 2004). Therefore, when the majority of detections are of unseen birds, it is preferable to collect data in distance groupings rather than using continuous distance estimates (Rosenstock et al. 2002). In distance groupings, the assumption concerning measuring accuracy is relaxed and the observations need only to be placed into the correct distance "band" (Buckland et al. 1993), greatly increasing accuracy and consistency among and within observers (Rosenstock et al. 2002). For the protocol described here, bird detections will be placed into 4 distance bands; 0 – 10m, 10 – 25m, 25 – 50m, and >50m. Additionally, each 10-minute point count will be divided into one minute listening periods, and observers will record the minute in which they heard each bird. This will facilitate analysis by removal modeling using five 2-minute time intervals. Removal models use the decreasing numbers of new birds counted in each time interval to estimate the number of birds missed during the count (Moore et al. 2004). This will also enable us to group the data for direct comparisons to other monitoring programs using 3- or 5-minute point counts, such as the North American Breeding Bird Survey (BBS).

It is important to note that in order to compute reliable detection probabilities for each species, 80-100 detections per observer are needed (Bibby et al. 1998). It is possible to calculate estimates from smaller samples, but these will be less precise. And while it is possible to pool data from multiple surveys to obtain adequate sample sizes for development of these detection functions, resulting estimates may still be an unreliable measure of differences in the actual number of birds present. However, it is still valuable to collect the data, and pooling of data over time may allow certain limited analyses. Interpretation of survey data requires sensitivity to these extra-statistical limitations of the estimation procedures.

1.2.2 Site Selection

Sampling locations are selected as described in SOP #3, "Establishing and Marking Sampling Plots." In locating study plots, 3 basic criteria were established; 1) point counts should be spaced approximately 250 m apart to avoid duplicate sampling while permitting observers to move efficiently between points; 2) points should be located at least 50 m from forest edges in order to maximize sampling effort on focal species and avoid fragmentation effects; and 3) points should be located within the dominant, mature forest cover types found in each park. In addition, point count stations should be located at least 25 m away from hiking trails and interpretive signing, and at least 50 m from park boundaries, roads, buildings, and other areas frequented by the public. To meet these criteria, sampling locations were selected by first overlaying a systematic 250-m grid onto park boundaries, vegetation types, forest vegetation sampling plots, and other data layers in ArcView GIS 3.2. Point counts were then selected at grid intersections that occurred within mature forest habitat. In some cases, points were moved slightly (ca. 10-30 m) in order to avoid park trails, steep slopes and other habitat features, or to maintain the 50-m spacing mentioned above. Groups of point counts were then stratified by forest cover type into discrete sampling units (hereafter called *study sites*), each consisting of between 5 and 10 points depending on park size and spatial configuration of major habitats within each park. This will reduce the number of habitat types, and therefore bird species, that individual volunteers will encounter during their survey routes, and should lower the chances that observers will encounter species they are unfamiliar with. At ACAD, study sites were located relatively close to park roads and away from excessively steep terrain to facilitate access by volunteer observers. At SARA, study sites were also established within grassland habitat since it represents a significant component of the natural communities at that park. Whenever possible, study sites will consist of 10 point counts in order to maximize the amount of data collected per volunteer visit. The number of point counts per park varies widely, primarily depending upon park size and amount of forested habitat (Table 1). Although at ACAD the number of points established was limited by the potential number of skilled volunteer observers perceived to be available (B. Connery pers. comm.). Since survey coverage at each park will depend on the availability of skilled volunteer birders, additional points can be added at ACAD in the future should the pool of volunteers be larger than anticipated. Wherever possible, bird monitoring study sites will be co-located within 50 m of at least one forest vegetation sampling plot so that future changes in bird populations can be compared with broad changes in forest structure, composition, and other variables.

1.2.3 Population Being Monitored

Sampling will be limited to the breeding season of migratory landbirds (mid-May through late-June, depending on latitude), and will include those species that may potentially breed in the park (see Appendix I). Thus, the population being sampled includes breeding bird species within the park boundary that use forested habitat (plus grasslands at SARA) and are present during the time that the survey is being conducted.

Table 1. Area of forested habitat (and grassland at SARA), and number of point counts and study sites at NETN parks.

NETN Park	Forested Habitat (ha)	Number of Point Counts	Number of Study Sites
Acadia NP	12,876	80	9-16
Marsh-Billings-Rockefeller NHP	197	25	3-5
Saint-Gaudens NHS	43	5	1
Minute Man NHP	194	27	3-5
Saratoga NHP - Forest	860	30	3-6
- Grassland	325	25	2-5
- Total	1,185	55	5-11
Roosevelt-Vanderbilt NHP	192	30	3-5
Weir Farm NHS	21	5	1
Morristown NHP	465	30	3-6

1.2.4 Sampling Frequency and Replication

For reducing within-year variability, studies indicate that sampling multiple plots at a site is preferable to replicate visits to a single plot (Link et al. 1994, Carlson and Schmiegelow 2002). In addition, variability is further reduced by limiting the number of observers conducting surveys. Therefore, each “study site” will be surveyed once annually and volunteer observers will be asked to survey at least 2 study sites each. The exception to this will be at the two smallest parks in the Network (SAGA and WEFA), which, due to their small sizes, can only accommodate one study site each. In order to reduce within-year variability at these two parks, study sites will be surveyed twice annually, with replicates occurring about 7-14 days apart. In order to reduce within- or between-site bias due to time of day, each study site will be surveyed in the same order each time (e.g. the order in which point counts are surveyed will not be reversed).

It is important to recognize the significance of maintaining observer consistency and continuity between survey years. The precision of population trends derived from data collected using this monitoring protocol will be increased if the same observer conducts the same survey(s) consistently each year for as many years as possible (Bart et al. 2004). Changes in observers or missed survey years reduce the precision, and therefore utility, of the data.

1.2.5 Power of Monitoring Protocol to Detect Change

Due to the small size of most NETN parks, the protocol described here will have relatively low power to detect population trends at individual parks for all but the most common species. For example, using the freeware program MONITOR (Gibbs 1995), the power of detecting declining trends for a moderately-abundant species (Wood Thrush) was calculated using survey data collected from 44 point count stations at MABI during a 2-year breeding bird inventory conducted during 2001 and 2002 (Faccio 2003). The analysis was run using 500 simulated data sets modeled using exponential trends, two-tailed hypothesis testing, a coefficient of variation (CV) of 0.52, and an alpha level of 0.10. The results of this simulation revealed that after 10 years of monitoring, the power to detect a 3% annual decline in Wood Thrush abundance was just 40%, and at 80% power an annual decline of between 8% and 9% could be detected (Fig. 2). Thus, it would be possible that low to moderately abundant species could exhibit long-term declines before the monitoring program collected enough data to detect them (Peterman and Bradford 1987). A power analysis conducted with data from the Ontario FBMP, indicated that 150 point count stations would be required to detect 2-3% annual declines (18-26% decline over 10 years) for the majority of landbird species with adequate power (80%) (Schalk et al. 2002). Similarly, a power analysis conducted using data from the Vermont FBMP, indicated that 75 point count stations detected a 5% annual decline in Ovenbirds (low CV) and a 6% annual decline in Hermit Thrush (moderate CV) over 10 years with a minimum of 80% power, while 15 years were required to detect a 3% decline (Table 2, Faccio et. al. 1998).

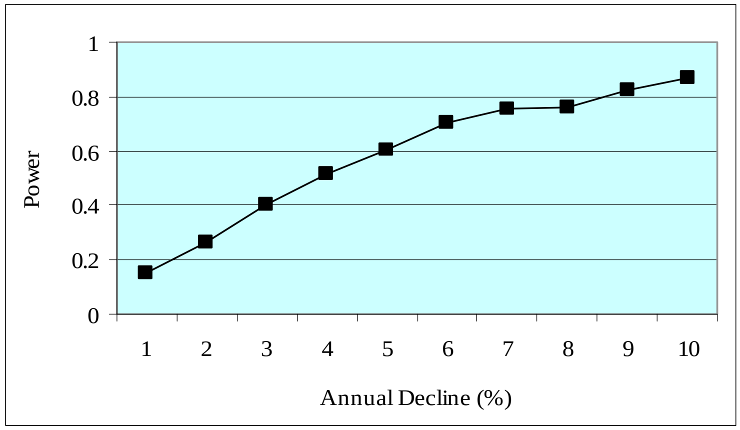


Fig. 2. Power to detect 1-10% annual declines in Wood Thrush abundance after 10 years of monitoring at 35 point counts at MABI.

Table 2. Power to evaluate trends for species with low variability (Ovenbird) and moderate variability (Hermit Thrush) occurring at 15 VT FBMP study sites, each with 5 point count stations and 2 counts/year.

Years Monitoring	Annual Decline (%)	Ovenbird (low CV) Power	Hermit Thrush (moderate CV) Power
10	6	0.97	0.86
	5	0.91	0.78
	4	0.79	0.63
	3	0.61	0.44
	2	0.37	0.23
15	6	1.00	1.00
	5	1.00	0.99
	4	1.00	0.95
	3	0.97	0.86
	2	0.76	0.61
20	6	1.00	1.00
	5	1.00	1.00
	4	1.00	1.00
	3	1.00	0.99
	2	0.98	0.89

However, because Network park data are being incorporated into the VT FBMP, power to detect population trends can be improved for 3 Network parks (MABI, SAGA, SARA) by combining their data with those from FBMP sites, thereby increasing sample sizes and reducing CVs for many species. Also, grouping species into habitat/foraging guilds or PIF priority groups, should improve the precision of trend estimates for individual parks.

1.3 Field Methods

1.3.1 Field Schedule and Preparations

The monitoring described in this protocol is implemented annually during June, although late-May surveys are suitable at MORR and WEFA. The ability to successfully complete the annual monitoring will hinge on thorough advance preparation. Because this is a volunteer-based monitoring program, the most important preparation is ensuring that skilled volunteer personnel are trained and available to accomplish the field work. Volunteer recruitment and training will be carried out by staff at individual Network parks, preferably by a Natural Resource Manager or Park Ranger familiar with park resources and the local birding community. Volunteers will need to be recruited well in advance of the field season, and survey materials and protocols mailed during the month prior to the start of the field season. In addition, any clearances necessary to gain access to park grounds during early morning hours (ca. 0400-0430) should be arranged (see SOP 1, Field Season Logistics).

1.3.2 Sampling Methods

Permanent sampling points will be located as identified above (see Site Selection) and marked with aluminum tree tags and blue flagging so they can be easily located by volunteer observers. SOP 3 (Establishing and Marking Avian Sampling Points) provides details about locating and marking sampling points, and SOP 4 (Conducting Point Counts) provides detailed instructions on the procedures for counting birds and examples of completed data sheets.

1.4 Data Management

1.4.1 Overview of Database Design

Bird monitoring data will be archived into the VT FBMP database at the Vermont Institute of Natural Science. The relational MS Access database consists of 6 linked tables, 2 of which hold data input annually about each survey, such as species counts, distance estimates, date, time, and study site, while the other 4 tables contain supporting information, including common names of birds, observer names and addresses, and location information. The tables and their relationships are as follows:

1. *Survey Completion List* – this table contains “event” information relating to each individual point count, including start time, observer, date, site and station number, and assigns a unique Survey ID Number.
2. *Count Data* – this table contains the raw data from each point count, including the unique Survey I-D Number, species observed, observation code, time interval during which the observation was made, and the distance category the bird was observed within. It is linked to the *Survey Completion List* by the Survey ID Number.
3. *Site and Station List* – stores “location” information about each point count, including site name and number, habitat type, location (town and state), GPS coordinates, and a unique Site-Station Number by which it is linked to the *Survey Completion List*.
4. *Observer List* – this table stores data about each observer, including name, address, email, phone number, the study site(s) they survey, whether they are currently active or inactive, and their unique Observer ID code. It is linked to the *Survey Completion List* by the Observer’s initials.

5. *Observation Type List* – this table contains the 6 codes used on observer field data forms to describe the type of observations made (e.g. singing male, calling individual, family group, individual visually observed, active nest observed, drumming) and assigns each code a raw number value of 1 or 2 depending on whether it confirms that nesting has occurred. It is linked to the *Count Data* table by the Observation Code.
6. *Species List* – this table contains a list of potential species, their common name, 4-letter code, taxonomic number, and migratory grouping. It is linked to the *Count Data* table via the 4-letter code.

The structure of the FBMP database is the same as that used for breeding bird inventories at MABI and SAGA during 2001 and 2002 (Faccio 2003 and 2003a).

1.4.2 Data Entry and Verification

Currently data are entered into the FBMP database via an Access data entry form. However, VINS is in the process of beta testing an online data entry system that allows volunteer observers to enter data into a separate database via a password-protected website. After all the data are entered and error-checked, records are appended to the full FBMP database. Once this system is refined and utilized by volunteers, it will greatly reduce the project costs associated with data entry.

Regardless of how data get into the database, data verification is necessary to ensure that values recorded on the field form and keyed into the database are correctly entered (i.e., the entered value is the "correct" value). Evaluating post-acquisition data is a potentially difficult but necessary task, regardless of the data source. Several steps are taken prior to, during, and after data entry to verify that data are correct and logical, including;

- Visual review at data entry. The data entry technician compares the date, time, species, and observation codes recorded on the Field Mapping Card with those transcribed onto the Data Coding Sheet to make sure they are consistent. In addition, the technician verifies each record after input and immediately corrects any errors;
- Visual review after data entry. Data entered into the database are compared visually to the original records, discrepancies are identified and reconciled;
- Summary queries and tallies. Error detection queries are used to detect duplicate, omitted, or unassociated records.

Additionally, the database entry form itself has features that reduce data entry errors. These include dropdown menus for site name, observer, and species and observation codes. These values may also be entered using the keyboard, but must conform to the codes listed in the appropriate tables above. For example, if the species code for Black-throated Green Warbler (BTNW) were incorrectly entered as BTGW, the record would not be accepted and an error message would appear.

1.5 Data Analysis

1.5.1 Data Summaries and Statistical Analysis

For each park, annual summaries of bird monitoring data will consist of relatively simple statistical tabulations providing a “snapshot” of the avian community. Annual results will also be compared to the mean values of previous years in order to gauge whether they are above or below “normal.” Data summaries will consist of the following metrics; total abundance, species richness, species diversity (Shannon-Wiener index), relative abundance, and frequency of occurrence (Table 3). Results for both total abundance and species richness metrics will also be broken down into native/non-native and resident/migrant categories. In addition, after 3 years of data collection, annual time series graphs of relative abundance by year will be plotted for the 10 most abundant species at each park and for PIF priority species as determined by BCR (see Appendix 1).

Table 3. Breeding landbird monitoring metrics and calculation from raw data.

Metric	Variable Type	Units	Calculation
Total Abundance	Index	Mean number of individuals/point	Total number of individuals of all species/total number of point counts surveyed
Species Richness	Index	Number of species	Sum of all species detected
Species Diversity (Shannon-Wiener)	Index	NA	$-\sum (pi)(\ln pi)$, where pi = proportion of the i^{th} species, and ln = natural log.
Species Relative Abundance	Index	Number of individuals/point	Number of individuals of a given species/number of points surveyed
Frequency of Occurrence	Percent	% of points where the species was detected	Number of points on which species was detected/total number of points surveyed

Periodically, perhaps every 5-10 years depending on perceived need and funding, a more detailed population trend analysis will be conducted, focusing on the most abundant species and those of management or conservation concern. Such an analysis will involve more sophisticated statistical modeling, and may include procedures such as estimating equations (Link and Sauer 1994), repeated measures ANOVA, hierarchical modeling, or other appropriate methods. This analysis will likely compare trends from NETN parks to those produced by the BBS or other regional programs such as the VT FBMP. Additionally, in order to produce more robust estimates of trend, species may be grouped into habitat/foraging guilds and Network parks may be grouped together by BCR, forest ecosystem, or other biologically appropriate groupings.

1.6 Data Reporting

1.6.1 Ecological integrity assessment and scorecard

The NETN I & M program recognizes the importance of effective communication and reporting to transform field data into a format that is both useful and clearly understood by park managers, scientists, the public, and policy makers. This will be accomplished by developing standard statistical summaries of vital sign measurements (see section 1.5), as well as developing an ecological integrity scorecard that provides basic interpretation of the status and trends for a given vital sign.

Table 4 lists the metrics to be used for the avian scorecard, along with the threshold values or ranking placing it in one of 3 basic categories; Good, Caution, or Significant Concern. An overall bird community metric (e.g. Total Score) is calculated by averaging the individual metrics. The threshold values for these metrics were determined from the following literature sources; Welsh and Healy (1993), Hagan et al. (1997), Faccio (2003, 2003a, 2003b), and Trocki and Paton (2003). While these sources are relevant to most of the Network parks, the values may be refined over time as park-specific data are accumulated and analyzed. Metrics may provide more useful information if they are calibrated by forest type or BCR rather than Network-wide.

Table 4. Avian scorecard metrics and rankings.

	Good		**Caution**		**Significant Concern**	
Metric	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Total abundance	≥7.0	Actual value	3.0-6.9	Actual value	<3.0	Actual value
Native species richness	≥17	Actual value	12-17	Actual value	<12	Actual value
Shannon diversity index	≥2.5	Actual value	1.8-2.4	Actual value	<1.8	Actual value
Number of exotics	0	4	1-2	2	3-4	0
Total Score (sum of Rank column ÷ 4)	>6.60		4.1-6.5		<4.0	

In addition, an assessment of the biotic integrity of the avian community based on an assemblage of behavioral and physiological response guilds, similar to O'Connell et al. (2000), will be used for forest birds (e.g. this scorecard will not be used for grassland bird surveys at SARA). Such a biotic integrity scorecard will help elucidate changes in a broader, landscape context and indicate in which direction the park may be moving along a disturbance gradient from "highly disturbed" or "urban," to "pristine" or "natural." Croonquist and Brooks (1991) demonstrated that response guilds, which are groups of species that require similar habitat, food, or other elements for survival, are effective indicators of habitat disturbance. Changes in availability of specific resources are manifested as population responses in the species dependant on that resource. For example, the loss of snags in a forest stand can result in the decrease in the guild of bark-probing insectivores. As O'Connell et al. (2000) indicate, an assessment of response guilds functions like an index of biotic integrity (Karr 1991, Karr and Chu 1999), providing a system-specific framework in which species assemblages can be ranked on a qualitative scale. This type of avian biotic integrity assessment provides a means to estimate condition that, unlike species richness or Shannon diversity, is not confounded by intermediate levels of disturbance as demonstrated by Blair (1996).

The guild-based biotic integrity scorecard is based upon O'Connell et al. (2000) and consists of 12 guilds in 7 guild categories (Table 5). Individual guilds were broadly categorized as "specialist" or "generalist." A specialist can be a species with a narrow range of habitat tolerances, or one that exhibits a low intrinsic rate of population increase. For our purposes, specialist guilds may be thought of as "guilds indicative of a high-integrity condition" while generalist guilds are "guilds indicative of a low-integrity condition." Guilds were selected to reflect different aspects of each species' life history traits. Therefore, species may belong to several guilds simultaneously, including both specialist and generalist guilds.

Table 5. Biotic integrity elements, guild categories, response guilds, and guild interpretations used in avian biotic integrity scorecard.

Biotic Integrity Element	Guild Category	Response Guild	Specialist	Generalist
Functional	Trophic	Omnivore		X
Functional	Insectivore forager	Bark prober	X	
Functional	Insectivore forager	Ground gleaner	X	
Functional	Insectivore forager	Canopy forager	X	
Compositional	Origin	Exotic		X
Compositional	Migratory	Resident		X
Compositional	Migratory	Temperate migrant		X
Compositional	Migratory	Tropical migrant	X	
Compositional	Number of broods	Single-brooded	X	
Compositional	Population limiting	Nest predator/brood parasite		X
Structural	Primary habitat	Forest generalist		X
Structural	Primary habitat	Interior forest obligate	X	

With species assigned to guilds (Appendix II), the proportional species richness of each guild is calculated, resulting in a rank ranging from 1 to 5, with 1 indicating "low" biotic integrity and 5 indicating "high" biotic integrity (Table 6). For example, a bird community at a given park in which 20% of the species are omnivores receives a rank of "5" for the omnivore guild. The total biotic integrity score for a park is simply the sum of the ranks for all 12 guilds. The theoretical minimum integrity score would be 16.0, while the theoretical maximum integrity score would be 58.5. Biotic integrity score thresholds are as follows:

Low Integrity	16.0-23
Medium Integrity	23.1-32.5
High Integrity	32.6-44
Highest Integrity	44.1-58.5

The proportional species richness scores and ranks are based on those derived by O'Connell et al. (2000) for birds in forested habitats in the central Appalachians. While these are likely appropriate for MORR, and possibly ROVA and WEFA, they may need to be adjusted for parks in more northern bioregions. Similarly, the integrity threshold values above can be refined over time.

Table 6. Biotic Integrity Ranks for 12 response guilds (based on O'Connell et al. 2000).

Biotic Integrity Element	Response Guild	Proportional Spp. Richness	Rank
Functional	Omnivore	0.000-0.290	5
		0.291-0.410	4
		0.411-0.480	3
		0.481-0.580	2
		0.581-1.000	1
	Bark Probers	0.000-0.060	1.5
		0.061-0.110	3
		0.111-0.170	4
		0.171-1.000	5
	Ground Gleaner	0.000-0.050	1.5
		0.051-0.070	2
		0.071-0.140	4.5
		0.141-1.000	5
	Canopy Forager	0.000-0.030	1.5
		0.031-0.050	2
		0.051-0.120	3
		0.121-0.200	4.5
		0.201-1.000	5
	Shrub Gleaner	0.000-0.140	1.5
		0.141-0.230	2.5
		0.231-1.000	5
Compositional	Exotic Species	0.000	5
		0.101-0.150	3.5
		0.151-0.180	2
		0.181-1.000	1
	Resident	0.000-0.260	5
		0.261-0.390	3.5
		0.391-0.570	2
		0.571-1.000	1
	Temperate Migrants	0.000-0.210	4
		0.211-0.300	2
		0.301-1.000	1
	Single Brooded	0.000-0.410	1.5
		0.411-0.450	2
		0.451-0.610	3
		0.611-0.730	4
		0.731-1.000	5
	Nest Pred./Brood Parasite	0.000-0.100	5
		0.101-0.150	3.5
		0.151-0.180	2
		0.181-1.000	1
Structural	Forest Generalist	0.000-0.280	4.5
		0.281-1.000	2.5
	Interior Forest Birds	0.000-0.010	1
		0.011-0.080	1.5
		0.081-0.260	3
		0.261-0.430	4
		0.431-1.000	5

1.6.2 General reporting requirements

Avian survey data will be collected annually at each park. Following each field season, an annual report will be prepared summarizing the year's work. This will include routine summaries for each measure at each sampled park and for the network as a whole. The measures will be presented in a general framework that reflects the underlying conceptual model that the vital signs and measures are based upon. Periodically, perhaps every 5-10 years depending on perceived need and funding, a more detailed population trend analysis will be conducted, focusing on the most abundant species and those of management or conservation concern.

1.7 Literature Cited

Bart, J. and S. L. Earnst. 2002. Double sampling to estimate bird density and population trends. Auk 119:36-45.

Bart, J., S. Droege, P. Geissler, B. Peterjohn, and C. J. Ralph. 2004. Density estimation in wildlife surveys. Wildlife Society Bulletin 32:1242-1247.

Bibby, C., M. Jones, and S. Marsden. 1998. Expedition Field Techniques: Bird Surveys. Expedition Advisory Centre, Royal Geographic Society, London, UK.

Blair, R. B. 1996. Land use and avian species diversity along an urban gradient. Ecological Applications 6: 506-519.

Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance Sampling: Estimating Abundance of Biological Populations. Chapman and Hall, New York.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: Estimating abundance of biological populations. Oxford University Press, Oxford UK.

Carlson, M. and F. Schmiegelow. 2002. Cost-effective sampling design applied to large-scale monitoring of boreal birds. Conservation Ecology 6:11.

Croonquist, M. J., and R. P. Brooks. 1991. Use of avian and mammalian guilds as indicators of cumulative impacts in riparian-wetland areas. Environmental Management 15: 701-714.

Faaborg, J., M. Bittingham, T. Donovan, and J. Blake. 1995. Habitat fragmentation in the Temperate Zone. Pages 357-380 *in* T. E. Martin and D. M. Finch, editors. Ecology and Management of Neotropical Migratory Birds. Oxford University Press, Oxford, UK.

Faccio, S. D. 2003. A biological inventory of breeding birds at the Marsh-Billings-Rockefeller National Historical Park and adjacent lands, Woodstock, Vermont. National Park Service Technical Report NPS/NER/NRTR—2005/005.

Faccio, S. D. 2003a. A biological inventory of breeding birds at the Saint-Gaudens National Historic Site, Cornish, New Hampshire. National Park Service Technical Report NPS/NER/NRTR—2005/006.

Faccio, S. D. 2003b. Effects of ice storm-created gaps on forest breeding bird communities in central Vermont. Forest Ecology and Management 186:133-145.

Faccio, S. D., C. C. Rimmer, and K. P. McFarland. 1998. Results of the Vermont Forest Bird Monitoring Program, 1989-96. Northeastern Naturalist 5:293-312.

Farnsworth, G. L., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. Auk 119(2): 414-425.

Gibbs, J.P. 1995. MONITOR 7.0: Software for estimating the statistical power of population monitoring programs. USGS-Patuxent Wildlife Research Center, Laurel, MD. http://www.mbr-pwrc.usgs.gov/software/monitor.html

Hagan, J. M., P. S. McKinley, A. L. Meehan, S. L. Grove. 1997. Diversity and abundance of landbirds in a northeastern industrial forest. Journal of Wildlife Management 61:718-735.

Hutto, R. L., and J. S. Young. 2002. Regional landbird monitoring perspectives from the northern Rocky Mountains. Wildlife Society Bulletin 30:738-750.

Karr, J. R. 1991. Biological integrity: a long-neglected aspect of water resource management. Ecological Applications 1:66-84.

Karr, J. R., and E. W. Chu. 1999. Restoring Life in Running Waters: Better Biological Monitoring. Island Press, Washington, D.C.

Link, W. A., R. J. Barker, J. R. Sauer, and S. Droege. 1994. Within-site variability in surveys of wildlife populations. Ecology 75:1097-1108.

Link, W. A., and J. R. Sauer. 1994. Estimating equations estimates of trend. Bird Populations 2:23-32.

Maurer, B. A. 1993. Biological diversity, ecological integrity, and neotropical migrants. Pages 24-31 *in* Finch, D.M. and P. Stengel, editors. Status and Management of Neotropical Migrant Birds. USDA Forest Service General Technical Report RM 229, Forest and Range Experiment Station, Fort Collins, CO.

Moore, J. E., D. M. Scheiman, R. K. Swihart. 2004. Field comparison of removal and modified double-observer modeling for estimating detectability and abundance of birds. Auk 121(3): 865-876.

Nichols, J. D., J. E. Hines, J. R. Sauer, F. W. Fallon, J. E. Fallon, and P. J. Heglund. 2000. A double-observer approach for estimating detection probability and abundance from point counts. Auk 117:393-408.

North American Bird Conservation Initiative. 2000. North American Bird Conservation Initiative: Bird Conservation Region descriptions. U.S. Fish and Wildlife Service, Washington DC.

O'Connell, T. J., L. E. Jackson and R. P. Brooks. 2000. Bird guilds as indicators of ecological condition in the central Appalachians. Ecological Application 10:1706-1721.

Peterman, R.M., and M.J. Bradford. 1987. Statistical power of trends in fish abundance. Canadian Journal of Fisheries and Aquatic Sciences 44:1879-1889.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. USDA Forest Service General Technical Report PSW-GTR 144, Pacific Southwest Research Station.

Ralph, C. J., S. Droege, and J. R. Sauer. 1995. Managing and monitoring birds using point counts: standards and applications. Pages 161-168 *in* C. J. Ralph, J. R. Sauer, and S. Droege, editors. Monitoring Bird Populations by Point Counts. USDA Forest Service General Technical Report PSW GTR 149, Pacific Southwest Research Station.

Rich, T.D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Inigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, and T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology, Ithaca, NY.

Robinson, S. K., and D. S. Wilcove. 1994. Forest fragmentation in the Temperate Zone and its effects on migrating songbirds. Bird Conservation International 4:233-249.

Robinson, S. K., F. R. Thompson III, T. M. Donovan, D. R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267:1987-1990.

Rosenberg, K. V., J. D. Lowe, and A. A. Dhondt. 1999. Effects of forest fragmentation on breeding tanagers: A continental perspective. Conservation Biology 13:568-583.

Rosenstock, S. S., D. R. Anderson, K. M. Giesen, T. Leukering, and M. F. Carter. 2002. Landbird counting techniques: Current practices and an alternative. Auk 119:46-53.

Schalk, G., H.J. Dewar, and M.D. Cadman. 2002. Recommendations for assessing trends in forest bird populations based on the experience of the Ontario Forest Bird Monitoring Program. Journal of Field Ornithology 73:340-350.

Thompson, W. L. 2002. Towards reliable bird surveys: Accounting for individuals present but not detected. Auk 119:18-25.

Trocki, C., and P. Paton. 2003. Avian surveys in Northeast Temperate Network Parks. National Park Service Technical Report NPS/NER/NRTR—2005/004.

Welsh, C. J. E., and W. M. Healy. 1993. Effect of even-aged timber management on bird species diversity and composition in northern hardwoods of New Hampshire. Wildlife Society Bulletin 21:143-154.

Standard Operating Procedure (SOP) # 1
Field Season Logistics

Because this is a volunteer-based monitoring program, the most important preparation prior to the field season is to ensure that skilled volunteer personnel are trained and available to accomplish the field work. Prior to the field season each year, preferably in March or April, the NPS staff person responsible for recruiting volunteer bird observers at individual parks (see SOP #2 for volunteer recruitment & training) should contact the VT FBMP Coordinator at VINS with any changes to the list of volunteer observers. By 10 May each year, VINS will prepare a mailing to all volunteer observers that will include the following items:

- Field mapping cards and data coding sheets (see SOP #5 for examples) for the upcoming field season;
- List of point count stations and waypoints assigned to each observer;
- Written directions, map, and compass bearings to locate point count stations if GPS is unavailable or satellite reception is poor;
- Procedures for Distance Estimation training;
- Any recent summaries or reports resulting from the bird monitoring program;
- Cover letter thanking them for participating in the bird monitoring program, reminding them of the monitoring window dates and starting times, and encouraging them to review the protocol, including SOPs, prior to the field season. It is particularly important that observers review bird identification by sight and sound (SOP #2), since misidentification of a species is perhaps the most serious error observers can make during a bird count. Misidentification is much more serious than errors in estimating distances or double-counting a bird.

NPS staff at each park will also be responsible for acquiring any necessary clearances for volunteers, notifying park security if need be, or otherwise ensuring that observers have access to park property during early morning hours (ca. 0400-0430 hours) in order to arrive at their first point count station no later than 0500 hours.

Standard Operating Procedure (SOP) # 2
Recruiting and Training Volunteer Observers

This Standard Operating Procedure explains how to recruit volunteer observers and the training procedures that all observers should follow to learn how to identify birds by sight and sound, and how to estimate distances in the field.

I. Recruiting Volunteer Observers

Volunteer observers will be recruited from a variety of local sources, including bird clubs, Audubon Chapters, birding listservers, and via state BBS coordinators. Verifying potential participants' bird identification skills is very important, but testing multiple applicants is difficult, time consuming, and therefore costly. The Vermont FBMP has relied on word-of-mouth recommendations of local birders, as well as self-evaluation based on a description of the necessary abilities. More recently, the FBMP has developed a simple, self-administered, online auditory Bird Identification Quiz to help determine if potential observers have the necessary skills to participate in the program (http://www.vinsweb.org/cbd/FBMP_Quiz.html). Development of a more elaborate quiz that could be adjusted for geographic region within the Network, as well as habitat being surveyed (e.g. forest, grassland), would be a cost-effective tool with which the project manager could evaluate participants' bird identification abilities. In addition, it would provide potential observers with a way to self-evaluate their own ID skills.

II. Visual and Auditory Identification of Birds

The most essential component for the collection of credible, high-quality bird data is well-trained and experienced observers. This cannot be overemphasized. Proficient bird observers obtain species estimates within 90% of total species known to be present and estimate abundance within 80% accuracy (Ralph et al. 1993). Various studies have shown that observer bias is one of the most noteworthy bias factors in trend analysis of songbird populations (Kepler and Scott 1981, Baker and Sauer 1995). Before conducting VCP counts, read "Reducing bird count variability by training observers" by Kepler and Scott (1981) for a detailed discussion of training observers to identify birds by sight and sound as well as training them to estimate distances.

Procedures:

1. See Appendix I for a list of bird species likely to be encountered at each Network park. Beginning several months prior to the field season, review and practice bird identification skills.
2. Volunteer observers must possess excellent visual and auditory bird identification skills, and should be capable of identifying 90% of the bird species likely to be encountered.
3. Regardless of skill level, birders should spend time in the field familiarizing themselves with the birds in a park prior to starting a survey.
4. Suggested reference materials for conducting bird surveys at NETN Parks:
   - Tapes or CDs of bird songs for species found in Eastern U.S.
   - National Audubon Society Interactive CD-ROM Guide to North American Birds. This interactive CD-ROM is an excellent resource for learning calls, site ID and background

information on bird species.

- National Geographic. 1987. Field Guide to Birds of North America, 3rd Edition. National Geographic, Washington, D.C. 480 pages.
- The Sibley Field Guide to Birds of Eastern North America. 2003. Alfred A. Knopf, New York.

III. Estimating Distances to Birds Seen or Heard

Refer to the paper “Reducing bird count variability by training observers” by Kepler and Scott (1981) for a detailed discussion of training observers to identify birds by sight and sound as well as training them to estimate distances. Because it is not realistic to expect volunteers from all parks to be able to attend a training session, and it is not economically feasible to offer training sessions at each Network park, volunteers will be provided with the following distance training procedures and will be expected to practice distance estimation in a habitat similar to the one in which they will be surveying birds. All observers should recalibrate themselves by practicing these procedures at the beginning of each field season.

Procedure:

1. In a habitat similar to the one in which you will be conducting point counts, begin by placing flagging at 10 m, 25 m and 50 m from a marked central point (e.g. the point count station). To do this, volunteers will either need a 25m (or longer) tape, a laser rangefinder, or a measured length of rope.
2. Walk around the “study site” placing flagging at 4 or 5 locations visible from the station. Return to the central point and estimate the distance band (e.g. 0-10m, 10-25m, 25-50m, >50m) that each flag falls within, recording them in a field book. Then, using a measuring device, measure the distance to each flag and compare your initial estimate to the actual distance. Repeat this exercise several times until you can consistently estimate distances.
3. The majority of birds are usually heard but not seen, and estimating distances to birds that are only heard is often the greatest source of error in VCP counts. Standing at the central point, listen for vocalizing birds. Choose one consistently vocalizing individual and estimate the distance band in which it is singing. Remember, the horizontal distance should be estimated, as if a plumb-bob was lowered to the ground from the bird’s location. Try to visually identify the tree or branch where you think the bird is, and estimate the horizontal distance to an object that can be seen directly below where you think the bird is vocalizing from. Now, with one end of your measuring device affixed to the central point, slowly walk toward the vocalizing bird until you can either see it or accurately estimate its location. Compare your initial estimate to the actual distance. Repeat this exercise for several birds at various distances.

IV. Other Aspects of Training

Park or Network staff will ensure that volunteers are provided with and comfortable with equipment and equipment SOPs needed while they are in the field, including GPS navigation equipment and emergency communication equipment (e.g., park radios or cell phones). Volunteers will be encouraged to practice using navigation equipment and will also be encouraged to locate their point count sites during the day before their official counts. This will allow them to gain familiarity with survey locations and save time when they are conducting their counts.

V. References

Kepler, C. B. and J. M. Scott. 1981. Reducing bird count variability by training observers. Studies in Avian Biology 6:366-371.

Baker, R. J. and J. R. Sauer. 1995. Statistical aspects of point count sampling. Pages 125-130 in C. J. Ralph, J. R. Sauer and S. Droege, eds. Monitoring bird populations by point counts, USDA Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-149.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin and D. F. DeSante. 1993. Handbook of field methods for monitoring landbirds. USDA Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-144

Standard Operating Procedure (SOP) # 3
Establishing and Marking Sampling Points

This SOP explains the procedure for establishing and marking sampling plots.

Procedures:

1. Establishing Sampling Plots – In locating study plots, 3 basic criteria were established; 1) point counts should be spaced approximately 250 m apart to avoid duplicate sampling while permitting observers to move efficiently between points; 2) points should be located at least 50 m from forest edges in order to maximize sampling effort on focal species and avoid fragmentation effects; and 3) points should be located within the dominant, mature forest cover types found in each park. In addition, point count stations should be located at least 25 m away from hiking trails and interpretive signing, and at least 50 m from park boundaries, roads, buildings, and other areas frequented by the public. To meet these criteria, sampling locations were selected by first overlaying a systematic 250-m grid onto park boundaries, vegetation types, forest vegetation sampling plots, and other data layers in ArcView GIS 3.2. Point counts were then selected at grid intersections that occurred within mature forest habitat. In some cases, points were moved slightly (ca. 10-30 m) in order to avoid park trails, steep slopes and other habitat features, or to maintain the 50-m spacing mentioned above. Groups of point counts were then stratified by forest cover type into discrete sampling units (hereafter called study sites), each consisting of between 5 and 10 points depending on park size and spatial configuration of major habitats within each park. This reduces the number of habitat types, and therefore bird species, that individual volunteers encounter during their survey routes, and should lower the chances that observers will encounter species they are unfamiliar with. At ACAD, study sites were located relatively close to park roads and away from excessively steep terrain to facilitate access by volunteer observers. At SARA, study sites were also established within grassland habitat since it represents a significant component of the natural communities at that park. Whenever possible, study sites consist of 10 point counts in order to maximize the amount of data collected per volunteer visit. The number of point counts per park varies widely, primarily depending upon park size and amount of forested habitat. Although at ACAD the number of points established was limited by the potential number of skilled volunteer observers perceived to be available (B. Connery pers. comm.). Since survey coverage at each park will depend on the availability of skilled volunteer birders, additional points can be added at ACAD in the future should the pool of volunteers be larger than anticipated. Wherever possible, bird monitoring study sites will be co-located within 50 m of at least one forest vegetation sampling plot so that future changes in bird populations can be compared with broad changes in forest structure, composition, and other variables.

2. Marking Sampling Plots – It is critical that observers be able to move quickly from one point to the next in order to complete their survey before bird activity slows down around 9am. Therefore, each survey point must be identified with both a permanent (aluminum treetag) and visible marker (flagging tape) in order to facilitate their timely location by volunteer observers (Fig. 1). The amount of flagging at each point count station could be limited to a single "band" around the central tree, rather then two as indicated in Fig. 1. In addition, a small amount of flagging spaced every 50 to 100m in between points may be necessary to help guide observers to

the next listening station. This is especially important since GPS is not always reliable under the forest canopy in summer. Point count stations and flagging will be located at least 25 m away from hiking trails and interpretive signing, and at least 50 m from park roads, buildings, and other areas frequented by the public.

While it is possible that the flagging at each point count could be removed after surveys are completed, and re-flagged prior to conducting surveys the following year, that would require additional volunteer time. Such an expectation may not be feasible for all volunteers, especially if they live any distance from the park, and may reduce the pool of potential observers, which is already fairly small due to the high level of skill necessary to participate. Unless park staff are willing to commit to re-flagging each year, the preference is to leave flagging up year-round, and have volunteer observers replace it when necessary during the course of their surveys.

Figure 3.1. Example of Point Count markers; aluminum treetag and flagging tape.

Sampling points in grassland habitat at SARA, should be located during bird surveys using a GPS unit, eliminating the need for permanent marking of each point.

3. Park maps indicating plot locations and plot ID numbers will be printed and mailed to each observer prior to the start of the field season to assist them in navigating from point to point. Maps of NETN Parks with bird point locations are included (Figs. 3.2 – 3.9).

Fig. 3.2. Point Count stations at Weir Farm NHS, Wilton, CT.

Table 3.1. UTM coordinates for WEFA.

UTM_E	UTM_N	POINT_NUMB
629185	4568565	1
629430	4568300	2
629425	4568530	3
629595	4568700	4
629685	4568912	5

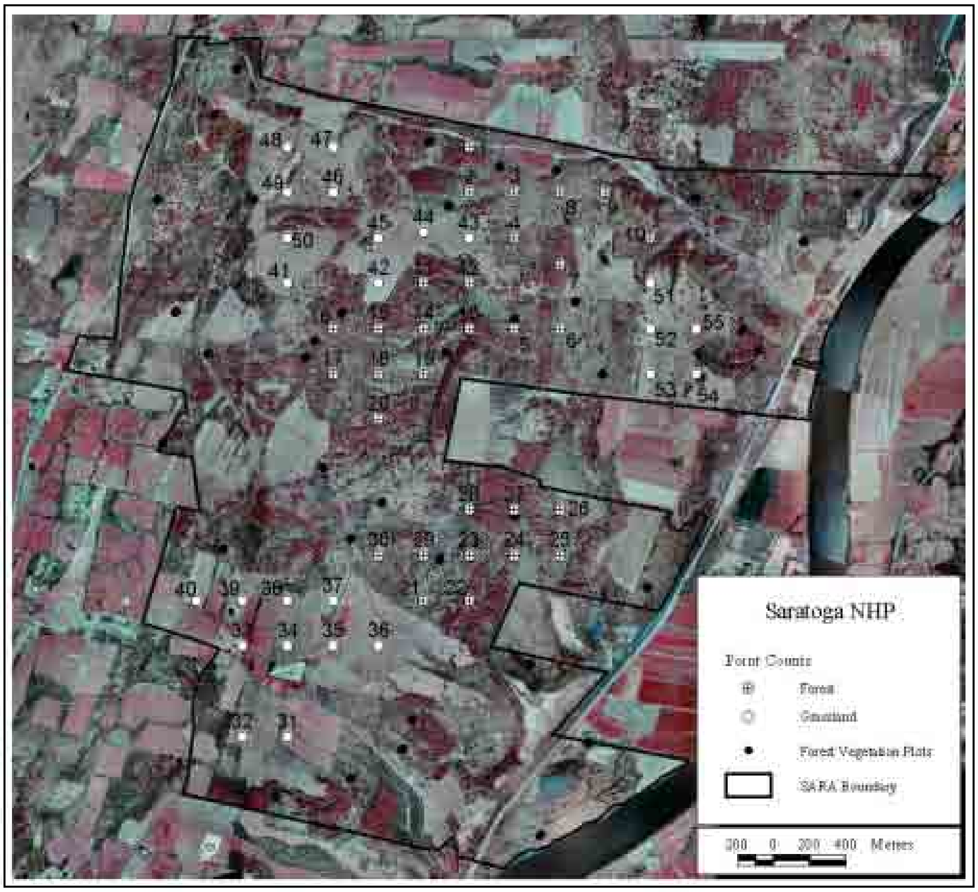


Fig. 3.3. Point count stations at Saratoga NHP, Saratoga, NY.

Table 3.2. UTM coordinates for SARA.

UTM_E	UTM_N	HABITAT	POINT_NUM
611500	4762750	Forest	1
611500	4762500	Forest	2
611750	4762500	Forest	3
611750	4762250	Forest	4
611750	4761750	Forest	5
612000	4761750	Forest	6
612000	4762100	Forest	7
612000	4762500	Forest	8
612250	4762500	Forest	9
612500	4762250	Forest	10
611250	4762000	Forest	11
611500	4762000	Forest	12
611500	4761750	Forest	13
611250	4761750	Forest	14
611000	4761750	Forest	15
610750	4761750	Forest	16
610750	4761500	Forest	17
611000	4761500	Forest	18
611250	4761500	Forest	19
611000	4761250	Forest	20
611250	4760250	Forest	21
611500	4760250	Forest	22
611500	4760500	Forest	23
611750	4760500	Forest	24
612000	4760500	Forest	25
612000	4760750	Forest	26
611750	4760750	Forest	27
611500	4760750	Forest	28
611250	4760500	Forest	29
611000	4760500	Forest	30
610500	4759500	Grassland	31
610250	4759500	Grassland	32
610250	4760000	Grassland	33
610500	4760000	Grassland	34
610750	4760000	Grassland	35
611000	4760000	Grassland	36
610750	4760250	Grassland	37
610500	4760250	Grassland	38
610250	4760250	Grassland	39
610000	4760250	Grassland	40
610500	4762000	Grassland	41
611000	4762000	Grassland	42
611500	4762250	Grassland	43
611250	4762280	Grassland	44
611000	4762250	Grassland	45
610750	4762500	Grassland	46
610750	4762750	Grassland	47
610500	4762750	Grassland	48
610500	4762500	Grassland	49
610500	4762250	Grassland	50
612500	4762000	Grassland	51
612500	4761750	Grassland	52
612500	4761500	Grassland	53
612750	4761500	Grassland	54
612750	4761750	Grassland	55

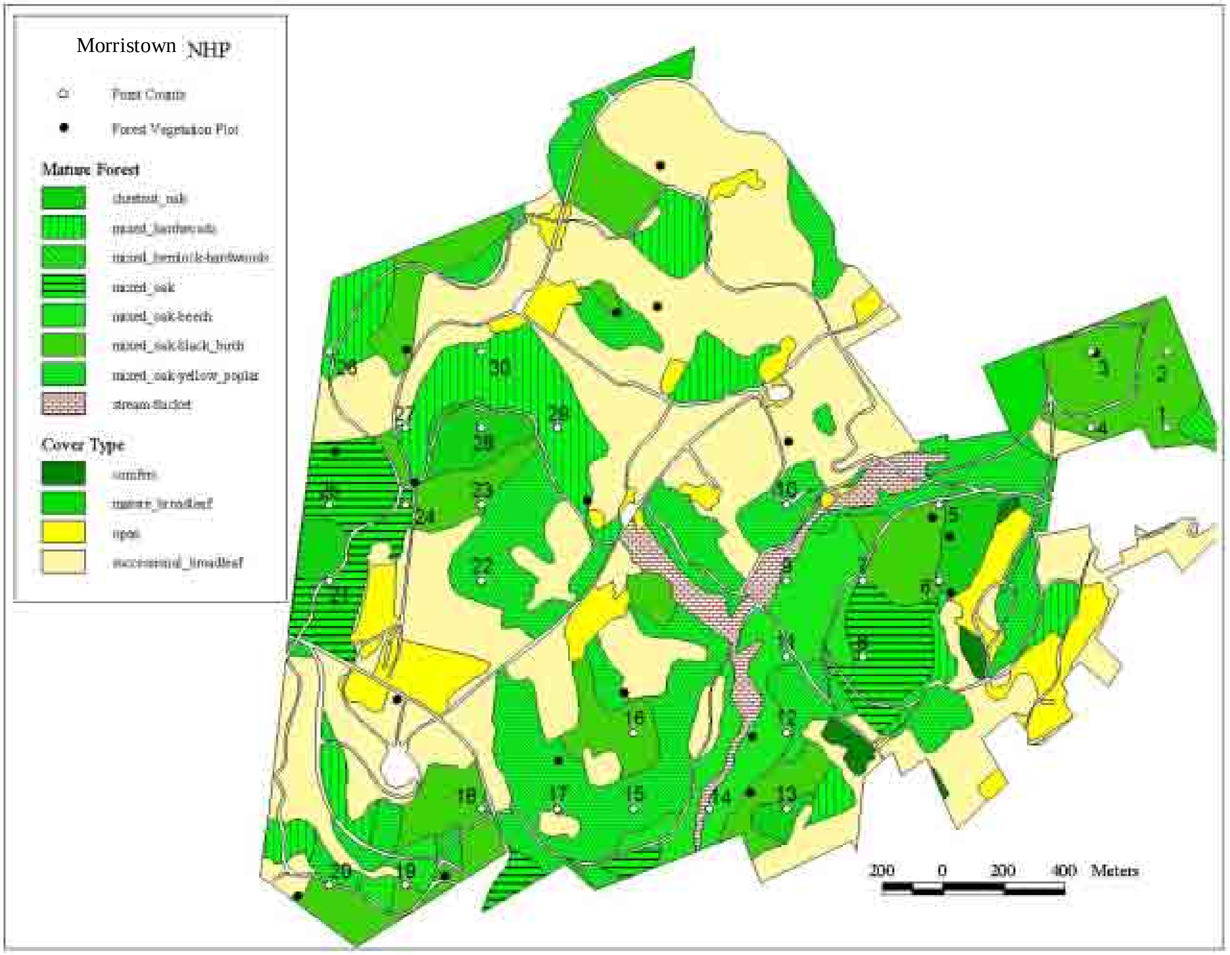


Fig 3.4. Point Count stations at Morristown NHP, Morristown, NJ.

Table 3.3. UTM coordinates for MORR.

UTM_N	UTM_E	HABITAT	POINT_NUM
4513500	541115	Deciduous Forest	1
4513750	541115	Deciduous Forest	2
4513750	540865	Deciduous Forest	3
4513500	540865	Deciduous Forest	4
4513250	540365	Deciduous Forest	5
4513000	540365	Deciduous Forest	6
4513000	540115	Deciduous Forest	7
4512750	540115	Deciduous Forest	8
4513000	539865	Deciduous Forest	9
4513250	539865	Deciduous Forest	10
4512750	539865	Deciduous Forest	11
4512500	539865	Deciduous Forest	12
4512250	539865	Deciduous Forest	13
4512250	539615	Deciduous Forest	14
4512250	539365	Deciduous Forest	15
4512500	539365	Deciduous Forest	16
4512250	539115	Deciduous Forest	17
4512250	538865	Deciduous Forest	18
4512000	538615	Deciduous Forest	19
4512000	538365	Deciduous Forest	20
4513000	538365	Deciduous Forest	21
4513000	538865	Deciduous Forest	22
4513250	538865	Deciduous Forest	23
4513250	538615	Deciduous Forest	24
4513250	538365	Deciduous Forest	25
4513750	538365	Deciduous Forest	26
4513500	538615	Deciduous Forest	27
4513500	538865	Deciduous Forest	28
4513500	539115	Deciduous Forest	29
4513750	538865	Deciduous Forest	30

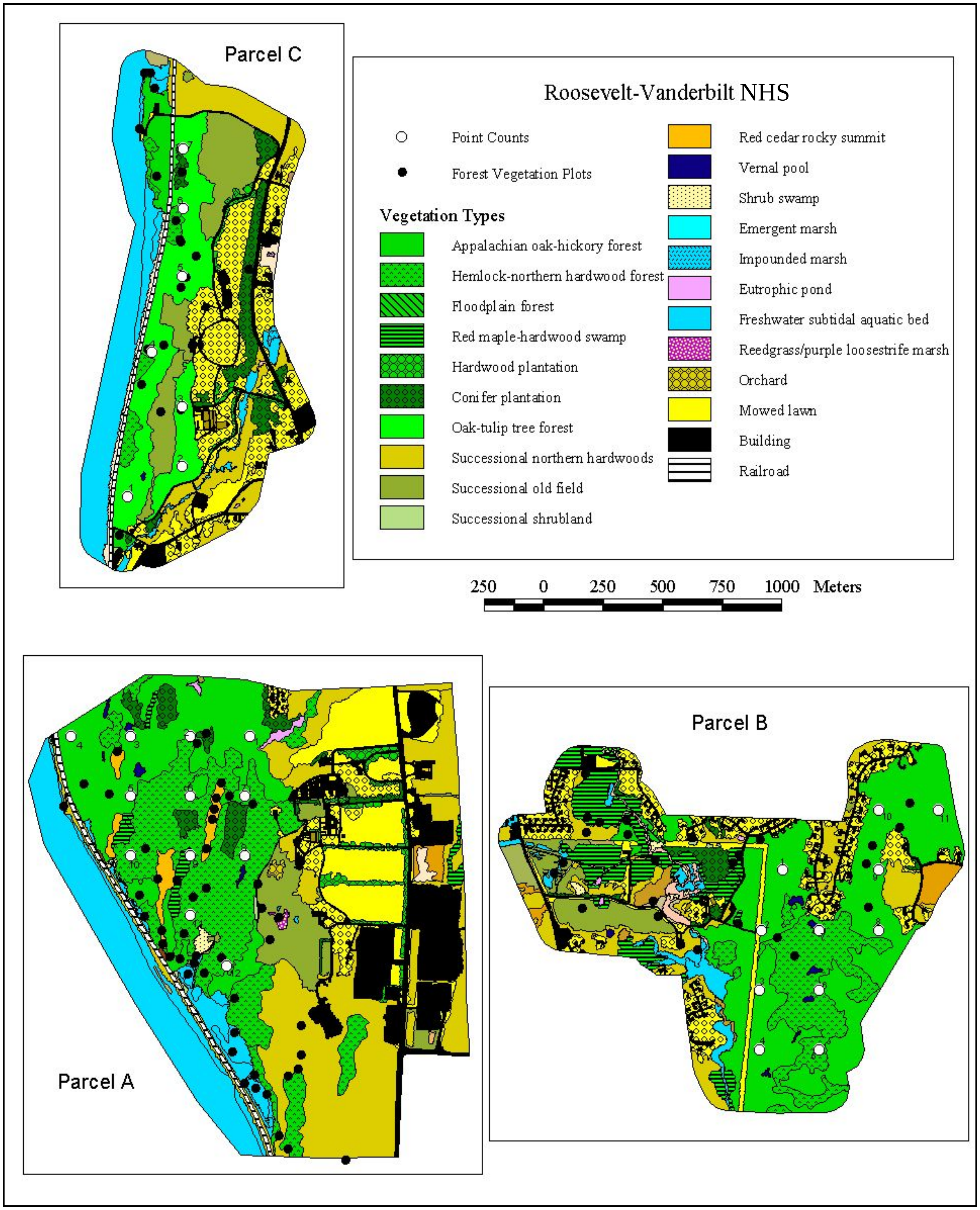


Fig. 3.5. Point count stations at Roosevelt-Vanderbilt NHS, NY.

Table 3.4. UTM coordinates for ROVA.

UTM_E	UTM_N	HABITAT	POINT_NUM	PARCEL
588275	4625000	oak-hickory	1	A
588025	4625000	oak-hickory	2	A
587775	4625000	oak-hickory	3	A
587525	4625000	oak-hickory	4	A
587775	4624750	hemlock-hardwood	5	A
588025	4624750	oak-hickory	6	A
588250	4624750	hemlock-hardwood	7	A
588250	4624500	oak-hickory	8	A
588025	4624500	hemlock-hardwood	9	A
587775	4624500	hemlock-hardwood	10	A
588025	4624250	hemlock-hardwood	11	A
588175	4624040	hemlock-hardwood	12	A
591850	4624200	oak-hickory	1	B
591760	4623950	oak-hickory	2	B
591750	4623700	oak-hickory	3	B
591750	4623450	oak-hickory	4	B
592000	4623450	hemlock-hardwood	5	B
592000	4623700	hemlock-hardwood	6	B
592000	4623950	hemlock-hardwood	7	B
592250	4623950	oak-hickory	8	B
592250	4624200	oak-hickory	9	B
592250	4624450	oak-hickory	10	B
592500	4624450	oak-hickory	11	B
587595	4627075	oak-hickory	1	C
587825	4627200	oak-hickory	2	C
587825	4627450	oak-hickory	3	C
587700	4627680	oak-hickory	4	C
587825	4628000	oak-hickory	5	C
587830	4628280	oak-hickory	6	C
587830	4628530	oak-hickory	7	C

Fig. 3.6. Point count stations at Minute Man NHP, Concord, MA.

Table 3.5. UTM coordinates for MIMA.

UTM_E	UTM_N	HABITAT	POINT_NUM
308838	4703469	Forest	1
309338	4703469	Forest	4
309588	4703469	Forest	5
308838	4703219	Forest, Wetland	2
309338	4702969	Forest	3
309838	4702969	Forest	6
309838	4702719	Forest	7
310838	4702969	Forest	9
310688	4702500	Forest	8
311088	4702969	Forest	10
311088	4702719	Forest	11
311088	4702439	Forest	12
311588	4702469	Forest	14
311450	4702280	Forest	13
311875	4702280	Forest	15
312338	4701969	Forest	16
312588	4701969	Forest	17
312838	4702219	Forest	19
312838	4701969	Forest	18
313088	4701969	Forest	20
313338	4702415	Forest	23
313338	4702219	Forest	22
313338	4701969	Forest	21
313588	4702219	Forest	24
313838	4702020	Forest	25
314088	4701969	Forest	26
314338	4701969	Forest	27

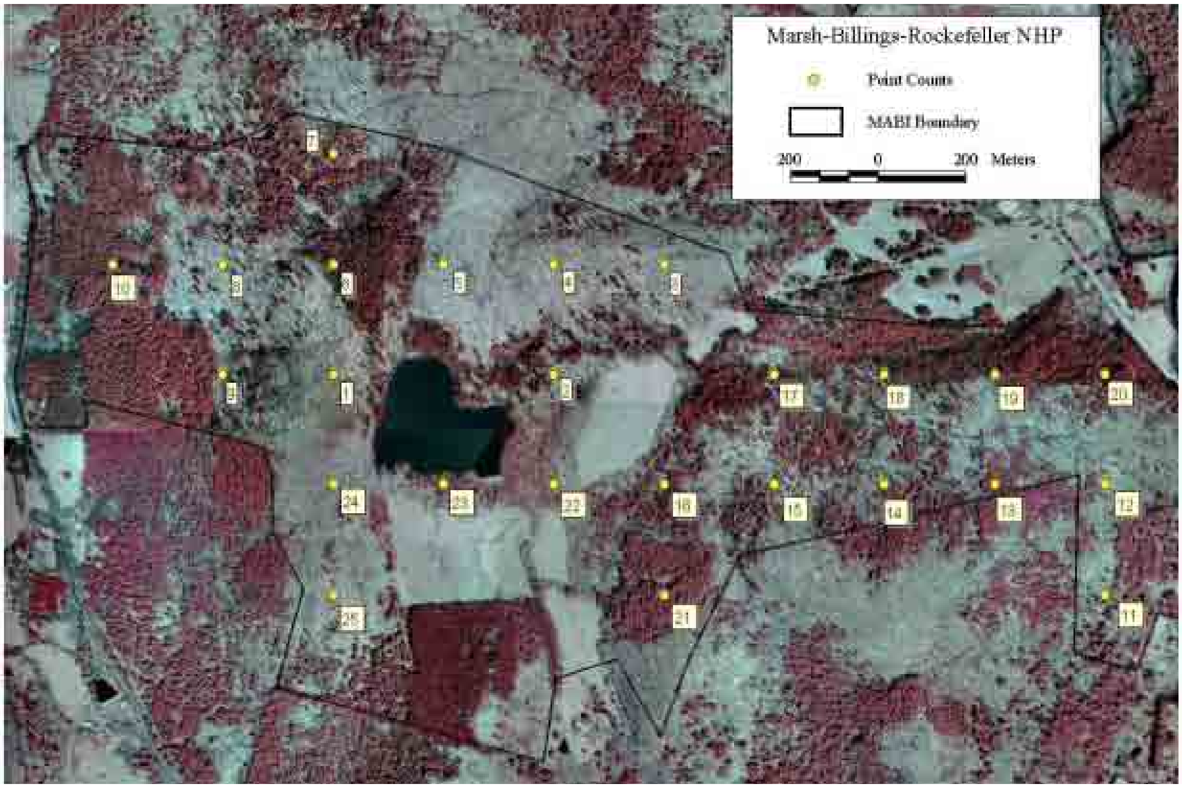


Fig. 3.7. Point count stations at Marsh-Billings-Rockefeller NHP, Woodstock, VT.

Table 3.6. UTM coordinates for MABI.

UTM_N	UTM_E	HABITAT	PT_NO
4834250	698000	N. hardwoods	1
4834250	698500	N. hardwoods/hemlock	2
4834500	698750	N. hardwoods	3
4834500	698500	N. hardwoods	4
4834500	698250	N. hardwoods	5
4834500	698000	hemlock/spruce/hardwoods	6
4834750	698000	N. hardwoods/hemlock	7
4834500	697750	N. hardwoods	8
4834250	697750	N. hardwoods	9
4834500	697500	red pine/hardwoods	10
4833750	699750	N. hardwoods/hemlock	11
4834000	699750	N. hardwoods/hemlock	12
4834000	699500	N. hardwoods/hemlock	13
4834000	699250	N. hardwoods/hemlock	14
4834000	699000	N. hardwoods/hemlock	15
4834000	698750	N. hardwoods/hemlock	16
4834250	699000	N. hardwoods/hemlock	17
4834250	699250	N. hardwoods/hemlock	18
4834250	699500	N. hardwoods/hemlock	19
4834250	699750	N. hardwoods/hemlock	20
4833750	698750	N. hardwoods/hemlock	21
4834000	698500	N. hardwoods/hemlock	22
4834000	698250	N. hardwoods/hemlock	23
4834000	698000	N. hardwoods	24
4833750	698000	N. hardwoods	25

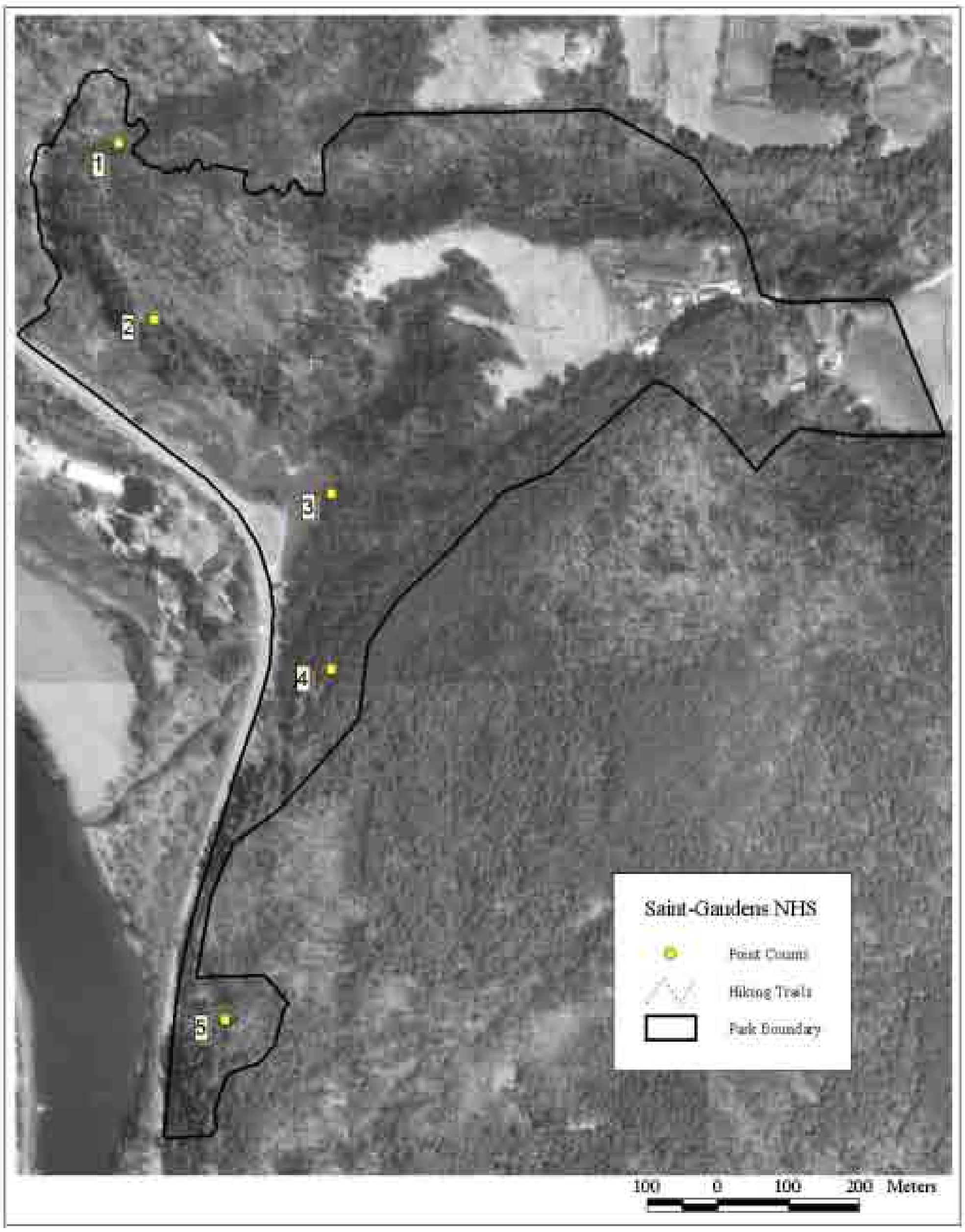


Fig. 3.8. Point count stations at Saint-Gaudens NHS, Cornish, NH.

Table 3.7. UTM coordinates for SAGA.

UTM_N	UTM_E	HABITAT	PT_NO
4820000	711950	N. hardwood/hemlock	1
4819250	712250	N. hardwood/hemlock	4
4819750	712000	N. hardwood/hemlock	2
4819500	712250	White pine/hemlock	3
4818750	712100	hardwoods	5

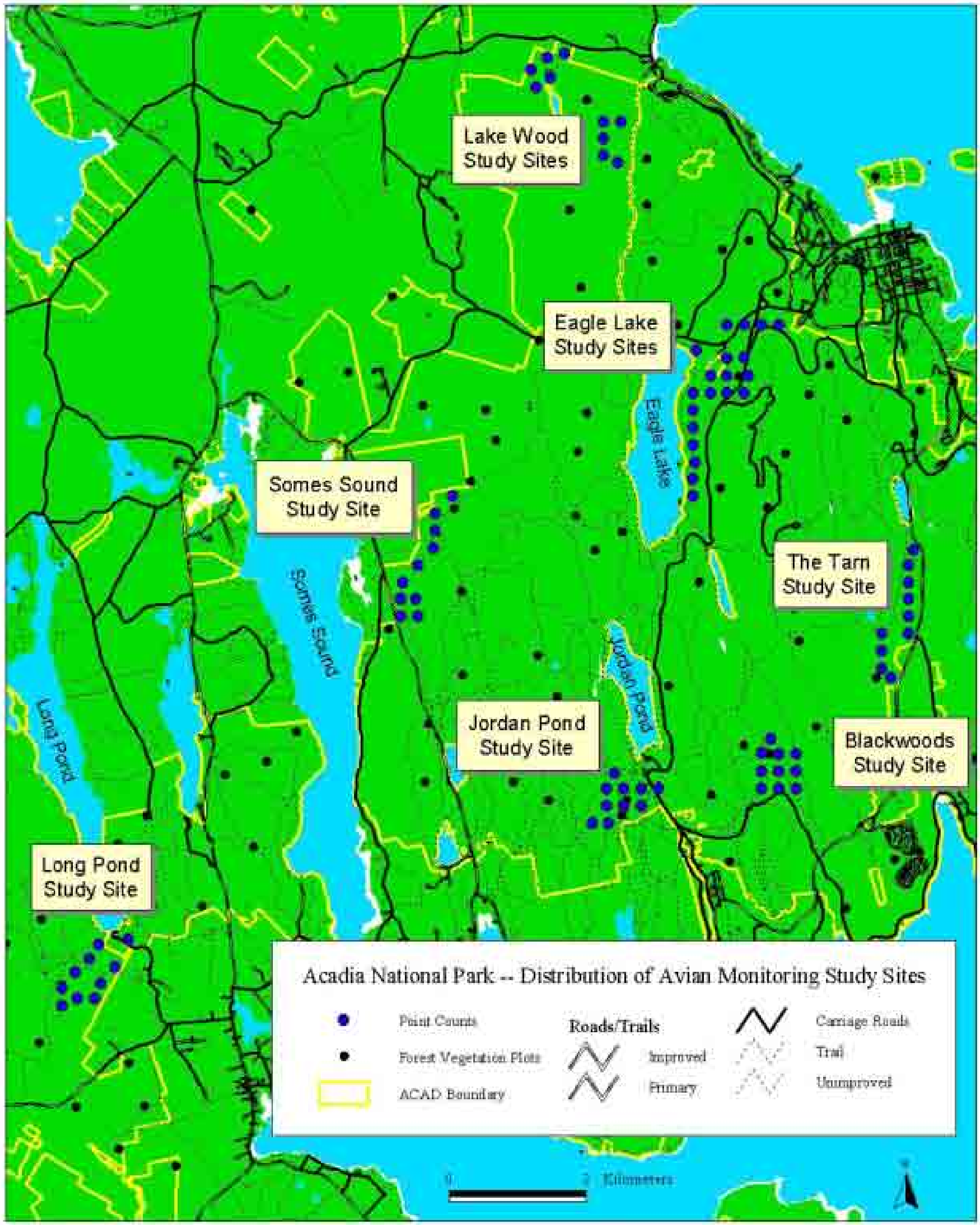


Fig. 3.9. Point count stations at Acadia NP, Bar Harbor, ME.

Table 3.8. UTM coordinates for ACAD.

UTM_E	UTM_N	POINT	STUDY SITE
556000	4910000	1	Somes Sound
556250	4910000	2	Somes Sound
556230	4910250	3	Somes Sound
556000	4910250	4	Somes Sound
556030	4910500	5	Somes Sound
556250	4910750	6	Somes Sound
556480	4911000	7	Somes Sound
556500	4911250	8	Somes Sound
556500	4911500	9	Somes Sound
556750	4911750	10	Somes Sound
561500	4914250	11	Eagle Lake
561250	4914250	12	Eagle Lake
561000	4914250	13	Eagle Lake
560990	4913770	14	Eagle Lake
561060	4913500	15	Eagle Lake
561000	4913250	16	Eagle Lake
560750	4913250	17	Eagle Lake
560750	4913500	18	Eagle Lake
560750	4913750	19	Eagle Lake
560750	4914250	20	Eagle Lake
560300	4913875	21	Eagle Lake
560500	4913500	22	Eagle Lake
560500	4913250	23	Eagle Lake
560250	4913250	24	Eagle Lake
560250	4913000	25	Eagle Lake
560250	4912750	26	Eagle Lake
560250	4912500	27	Eagle Lake
560280	4912250	28	Eagle Lake
560250	4912000	29	Eagle Lake
560250	4911750	30	Eagle Lake
563125	4909120	31	The Tarn
563000	4909250	32	The Tarn
563000	4909500	33	The Tarn
563000	4909750	34	The Tarn
563375	4909750	35	The Tarn
563375	4910000	36	The Tarn
563375	4910250	37	The Tarn
563375	4910500	38	The Tarn
563375	4910750	39	The Tarn
563450	4910975	40	The Tarn
561250	4907500	41	Blackwoods
561500	4907750	42	Blackwoods
561250	4907750	43	Blackwoods
561250	4908020	44	Blackwoods
561375	4908225	45	Blackwoods

561500	4908000	46	Blackwoods
UTM_E	UTM_N	POINT	STUDY SITE
561750	4908000	47	Blackwoods
561750	4907750	48	Blackwoods
561750	4907500	49	Blackwoods
561500	4907500	50	Blackwoods
559750	4907500	51	Jordan Pond
559500	4907500	52	Jordan Pond
559500	4907250	53	Jordan Pond
559250	4907250	54	Jordan Pond
559030	4907000	55	Jordan Pond
558780	4907000	56	Jordan Pond
559000	4907250	57	Jordan Pond
559000	4907500	58	Jordan Pond
559250	4907500	59	Jordan Pond
559120	4907720	60	Jordan Pond
551610	4905235	61	Long Pond
551475	4905025	62	Long Pond
551275	4904825	63	Long Pond
551075	4904600	64	Long Pond
551075	4904350	65	Long Pond
551300	4904450	66	Long Pond
551550	4904450	67	Long Pond
551650	4904675	68	Long Pond
551850	4904900	69	Long Pond
552050	4905300	70	Long Pond
558380	4918180	71	Lake Woods
558130	4918125	72	Lake Woods
557900	4917950	73	Lake Woods
557975	4917700	74	Lake Woods
558180	4917850	75	Lake Woods
559200	4917200	76	Lake Woods
558950	4917200	77	Lake Woods
558950	4916950	78	Lake Woods
558950	4916700	79	Lake Woods
559160	4916600	80	Lake Woods

Standard Operating Procedure (SOP) # 4
Conducting Variable Circular Plot Point Counts

This SOP provides step-by-step instructions for conducting the recommended 10 minute variable circular plot point count. For each bird observed, the time (minute of the count) and distance band (0-10 m, 10-25 m, 25-50 m, and >50 m) will be recorded. The methodology is largely based on songbird monitoring protocols developed for the Lower Mississippi Valley Joint Venture, available at www.lmvjv.org/population_monitoring.

The data being collected during point counts will be analyzed with two different methods (distance sampling and removal models), each of which is an independent approach to estimating the probability of detecting an individual. If we can accurately estimate this probability, we can estimate the number of birds that were NOT seen or heard during the point count, and derive a better estimate of bird abundance than we would get using only birds actually seen or heard. It is important to understand the assumptions of these methods, and to work to meet these assumptions. Both approaches assume that birds are correctly identified to species, and that each individual is only recorded once. The distance sampling approach further assumes that all birds within 10 meters of the observer (the first distance band) are always detected, and that the distance band recorded is the correct distance band. The removal modeling approach assumes that the time recorded for the individual bird is the time it was first heard or seen, and that observers are equally likely to hear a bird of a given species during every minute (in other words, the observer is just as likely to hear or see a Brown Creeper at minute one as he or she is at minute five).

When observers are collecting data, they should keep in mind that the most important assumptions are that birds are correctly identified to species, and that each individual is recorded only once. The next most important assumptions are that all birds close to you (within 10 meters) are recorded, and that distance estimates are correct. The removal modeling assumptions are less important, and all other data that are collected (e.g., sex, nest location, and whether the bird is singing, calling, or seen) are secondary to the primary goals of getting accurate species and distance information. If observers feel that they are unable to meet the assumptions of the distance sampling or the removal modeling approaches, they should provide a written comment with as much detail as possible when they submit their data forms. This will be a tremendous help to the data analysis phase of the project!

Procedure for Counting Birds:

1. Prior to the day of the counts, determine which points will be sampled. Also, determine and upload the coordinates for each point into a GPS.

2. Sampling will occur early in the morning. We recommend a 0500 start time at Point 1.

3. Winds should be calm to light (< 7 mph; Code 2 or less on the Beaufort Scale, Table 3). Clear conditions or slightly damp are ideal. Counts should not be conducted in rain, unless it is very light. <u>The rule is to conduct surveys only in weather that is unlikely to reduce count</u>

numbers. Generally, the better the weather, the better the count. If poor conditions are encountered, either wait until the weather improves or cancel the sampling for the day and reschedule.

4. Upon arriving at the sampling point, record the wind and sky conditions (Tables 2 and 3), temperature, date, site name, and observer. Prior to beginning count, orient the field mapping card (Fig. 1) to a fixed direction, record direction in box at the top of count circle, and record wind direction.

5. If exact location is not already known, position a GPS unit and start it recording.

6. As soon as possible, record the start time and begin the count. Use a pocket timer or watch to keep track of time.

7. Count (record) all birds and squirrels* (see box below) seen and heard during the 10 minute sampling period. Be sure to note in which minute birds are first encountered. This will require close attention to your watch or stopwatch. The minute code to note down is the digit in the minutes place on your stopwatch (i.e. 0 for the first minute through 9 for the last minute).

Record birds encountered as described below, but place the minute code after the 4 letter bird code. A sample field card is included as an example (Fig. 1). Remember, only count a bird the first time you see or hear it. Each individual bird you encounter should only be recorded once on the summary data coding sheets.

* Because red squirrels, gray squirrels, and Eastern chipmunks are known to be effective nest predators, we want to monitor their populations as well as those of forest birds. Follow the same recording procedures for these mammals as you would for birds using these 4-letter codes:

RESQ - red squirrel
GRSQ - gray squirrel
CHIP - Eastern chipmunk

8. Counting is done by mapping all observations (both visual and auditory) on the field mapping cards provided, keeping track of movements as best you can. Mapping (marking the exact location and noting movements) is the best way to reduce duplicate records. Mark birds on the field card in the appropriate distance band and approximate spatial location. Different symbols are used to record the status of each bird observation (i.e. singing male, pair observed, family group, nest, calling bird, territorial encounter, etc., Appendix 1). Use standard species AOU codes to identify species observed (4 letter codes can be found in Appendix 2, or downloaded at www.vinsweb.org/cbd/FBMP).

9. Holding the field mapping card in a fixed position, spend part of the time facing in each of the cardinal directions in order to better detect birds.

10. Mark each bird once, using the mapped locations to judge whether subsequent songs are from new or already recorded individuals. All birds greater than 50 m from point center are recorded outside of the 50 m band; likewise, flyovers should be listed separately. The recorded distance should be the horizontal distance between the location a bird was first detected and the

plot center. Imagine dropping a plumb-bob down from a bird's location and estimating its distance from the plot center. For species that occur in flocks, record the flock (e.g., species) and flock size in the appropriate distance band. There is no need to record each bird in a flock individually.

11. Do not record any birds believed to have been counted at previous stations. All birds should only be counted once.

12. At the end of 10 minutes, stop recording bird observations. Do not record any new birds seen or heard after the 10 minutes have passed.

13. Record the latitude and longitude coordinates from the GPS unit and mark the location with a waypoint.

14. Each site should be sampled once during the breeding season, except at Saint-Gaudens NHS and Weir Farm NHS, where sites will be sampled twice. At parks with two sampling periods, try to space your visits about 7-14 days apart. The first visit is called Series 1 and the second Series 2.

15. Field notations from the field mapping card should be transcribed to a point count data coding sheet (Fig. 2) before they are entered into the FBMP Online Database (www.vinsweb.org/cbd/FBMP). The transcription process will facilitate data entry.

16. After data have been entered into the online database, mail both the field mapping cards and data sheets to: Forest Bird Monitoring Program
VINS
2723 Church Hill Rd.
Woodstock, VT 05091

Table 1. Description of variables recorded at point count locations.

Variable	Description
State	State
Site	Name of park, forest, management area, refuge, etc...
Series	First or second series of annual point count surveys conducted
Point #	Number of the point within the study site.
Date	MM/DD/YYYY
Observer	Observer identification (e.g., initials).
Time	Time of day; 2400 hour clock (e.g., 0732).
Temp ˚F	Temperature in degrees Fahrenheit.
Sky	Sky condition, combining cloud cover and precipitation (see Table 2).
Wind	Wind speed from Beaufort scale (see Table 3).
Flyovers	Birds observed flying over the plot.
Comments	Notes and specific remarks about the count.

Table 2. Codes and descriptions for sky conditions[1].

Sky Conditions:

Code #	Description
0	Clear or a few clouds
1	Partly cloudy (scattered)
2	Cloudy (broken) or overcast
4	Fog
5	Drizzle
6	Rain
7	Snow

[1] These are the same codes used in the Breeding Bird Survey. Acceptable conditions for counting birds include a sky condition of 5 or less (although fog should not interfere with visual identification of birds), and wind speed of code 3 or less.

Table 3. Codes and descriptions for wind speeds (Beaufort Scale)[1].

Wind Speed Codes:

Code #	km/h	mph	Description
0	< 2	< 1	Smoke rises vertically
1	2 to 5	1 to 3	Wind direction shown by smoke drift
2	6 to 11	4 to 7	Wind felt on face; leaves rustle
3	12 to 20	8 to 12	Leaves, small twigs in constant motion; light flag extended
4	21 to 32	13 to 18	Small branches are moved
5	33 to 30	19 to 24	Small trees begin to sway

[1] These are the same codes used in the Breeding Bird Survey. Acceptable conditions for counting birds include a sky condition of 5 or less (although fog should not interfere with visual identification of birds), and wind speed of code 3 or less.

Figure 1. Example of Field Mapping Card

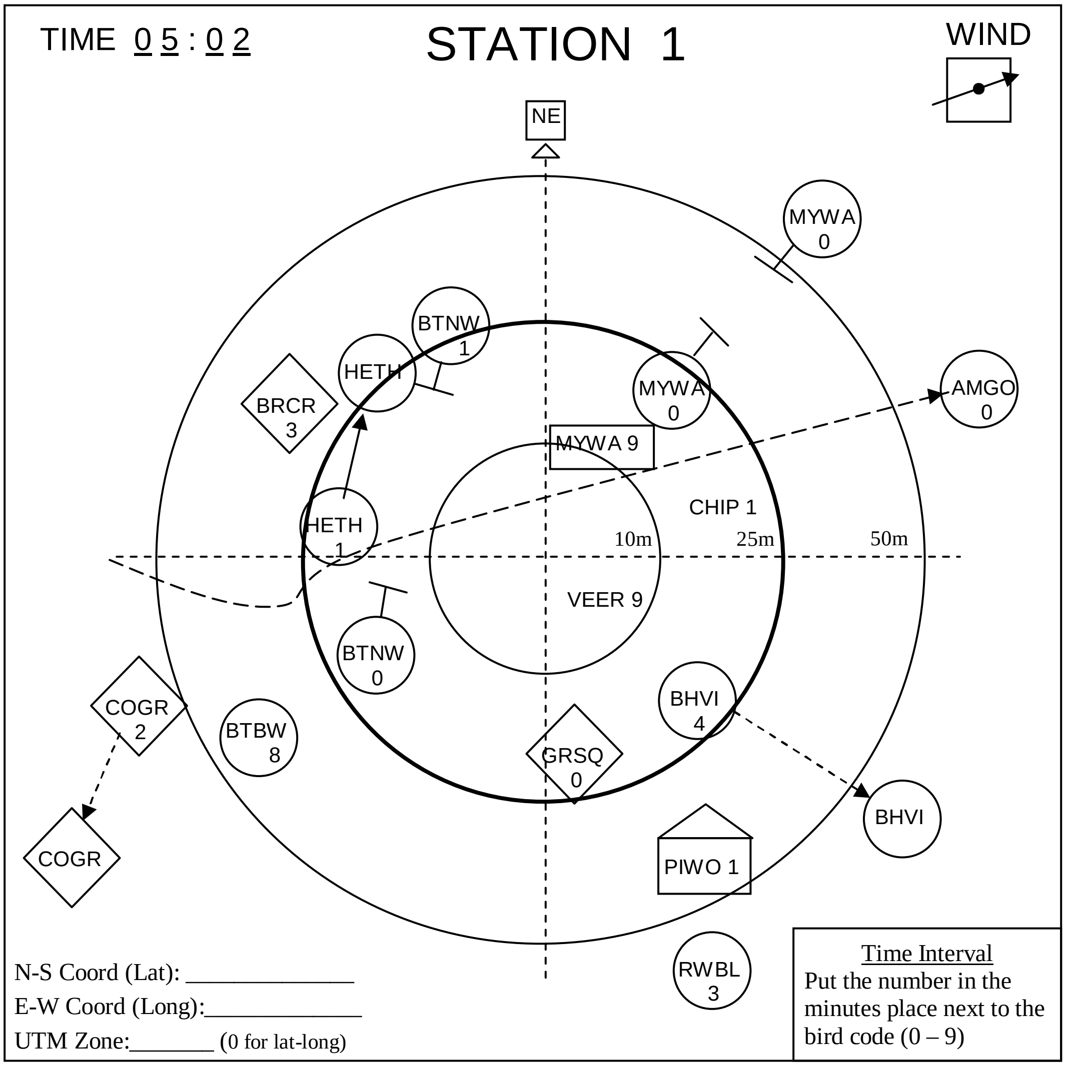


Figure 2. Example of a Data Coding Sheet

Data Coding Sheet – Forest Bird Monitoring Program

Site Name: Example **Date:** 6 June 2006 **Series:** 1

Observer: Bob O. Link **Initials:** BOL

Start Time	Point #	Species	Time	Obs Code	Distance Band	Flyovers/# in flock
0502	1	1. HETH	1	S	2	
		2. BRCR	3	C	3	
		3. AMGO	0	S		X
		4. BTNW	1	S	3	
		5. BTNW	0	S	2	
		6. BTBW	8	S	3	
		7. COGR	2	C	4	
		8. MYWA	9	I	1	
		9. MYWA	0	S	2	
		10. MYWA	0	S	4	
		11. CHIP	1	I	2	
		12. VEER	9	I	1	
		13. GRSQ	0	C	2	
		14. BHVI	4	S	2	
		15. PIWO	1	I	3	
		16. RWBL	1	I	3	
		17. RWBL	3	S	4	
		18.				
		19.				
		20.				
		21.				
		22.				
		23.				

Start Time	Point #	Species	Time Period	Obs Code	Distance Band	Flyovers/ # in flock
		24.				
		25.				
		26.				
		27.				
		28.				
		29.				
		30.				
		31.				
		32.				
		33.				
		34.				
		35.				
		36.				
		37.				
		38.				
		39.				
		40.				
		41.				
		42.				
		43.				
		44.				
		45.				
		46.				

Time Period – Enter the time code (minute of the count when the bird was first observed). This is the digit displaying in the minutes place of your timer (0 through 9).

Codes used for bird occurrence – *Place the appropriate code from the list below in the* "Obs Code" *field in the table above*

Singing male = **S** Calling = **C** Drumming = **D** Individual seen = **I** Family group = **F** Active nest = **N** Flock = **FL**

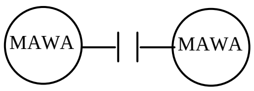
Distance Band – *use the following codes to denote distance* – **1 =** 0-10m **2 = 10**-25m **3 = 25-**50m **4 =** >50m

Flyovers/# in flock – *place an* X *in column to denote flyovers, and/or a number to denote individuals observed in flocks.*

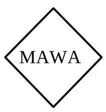
Appendix 1. Standard symbols used for mapping bird locations. Magnolia Warbler in this example.

Position of singing male

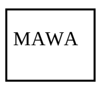
Approximate position of singing



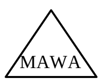
Counter-singing within a short time period; indicates 2 interacting



Calling, sex unknown



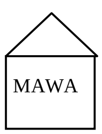
Female observed



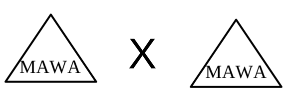
Male observed

MAWA

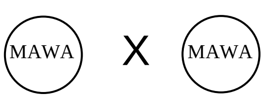
Observed, sex unknown



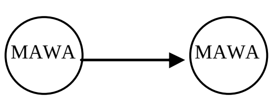
Pair observed together, assumed



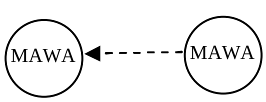
Observed conflict between males, dispute over boundary



Vocal defense of territories between males; specifically implies a territory boundary



Known change in position



Assumed change in position

MAWA ✳

Nest

Appendix 2. Alphabetical List of Vermont FBMP Species and 4-letter codes

COMMON NAME	CODE
ALDER FLYCATCHER	ALFL
AMERICAN CROW	AMCR
AMERICAN GOLDFINCH	AMGO
AMERICAN KESTREL	AMKE
AMERICAN REDSTART	AMRE
AMERICAN ROBIN	AMRO
BALTIMORE ORIOLE	BAOR
BANK SWALLOW	BANS
BARN SWALLOW	BARS
BARRED OWL	BDOW
BAY-BREASTED WARBLER	BBWA
BELTED KINGFISHER	BEKI
BICKNELL'S THRUSH	BITH
BLACK-AND-WHITE WARBLER	BAWW
BLACK-BACKED WOODPECKER	BBWO
BLACK-BILLED CUCKOO	BBCU
BLACKBURNIAN WARBLER	BLBW
BLACK-CAPPED CHICKADEE	BCCH
BLACKPOLL WARBLER	BLPW
BLACK-THROATED BLUE WARBLER	BTBW
BLACK-THROATED GREEN WARBLER	BTNW
BLUE JAY	BLJA
BLUE-GRAY GNATCATCHER	BGGN
BLUE-WINGED WARBLER	BWWA
BOBOLINK	BOBO
BOREAL CHICKADEE	BOCH
BROAD-WINGED HAWK	BWHA
BROWN CREEPER	BRCR
BROWN THRASHER	BRTH
BROWN-HEADED COWBIRD	BHCO
CANADA WARBLER	CAWA
CAPE MAY WARBLER	CMWA
CAROLINA WREN	CARW
CEDAR WAXWING	CEDW
CERULEAN WARBLER	CERW
CHESTNUT-SIDED WARBLER	CSWA
CHIMNEY SWIFT	CHSW
CHIPPING SPARROW	CHSP
CLIFF SWALLOW	CLSW
COMMON GRACKLE	COGR
COMMON NIGHTHAWK	CONI
COMMON RAVEN	CORA
COMMON YELLOWTHROAT	COYE
COOPER'S HAWK	COHA
DOWNY WOODPECKER	DOWO

COMMON NAME	CODE
EASTERN BLUEBIRD	EABL
EASTERN CHIPMUNK	CHIP
EASTERN KINGBIRD	EAKI
EASTERN MEADOWLARK	EAME
EASTERN PHOEBE	EAPH
EASTERN SCREECH-OWL	EASO
EASTERN TOWHEE	EATO
EASTERN TUFTED TITMOUSE	ETTI
EASTERN WOOD-PEWEE	EAWP
EUROPEAN STARLING	EUST
EVENING GROSBEAK	EVGR
FIELD SPARROW	FISP
FISH CROW	FICR
GOLDEN-CROWNED KINGLET	GCKI
GOLDEN-WINGED WARBLER	GWWA
GRASSHOPPER SPARROW	GRSP
GRAY CATBIRD	GRCA
GRAY JAY	GRAJ
GRAY SQUIRREL	GRSQ
GREAT HORNED OWL	GHOW
GREAT-CRESTED FLYCATCHER	GCFL
HAIRY WOODPECKER	HAWO
HENSLOW'S SPARROW	HESP
HERMIT THRUSH	HETH
HOUSE FINCH	HOFI
HOUSE SPARROW	HOSP
HOUSE WREN	HOWR
INDIGO BUNTING	INBU
LEAST FLYCATCHER	LEFL
LINCOLN'S SPARROW	LISP
LOUISIANA WATERTHRUSH	LOWA
MAGNOLIA WARBLER	MAWA
MARSH WREN	MAWR
MOURNING DOVE	MODO
MOURNING WARBLER	MOWA
MYRTLE WARBLER	MYWA
NASHVILLE WARBLER	NAWA
NORTHERN CARDINAL	NOCA
NORTHERN GOSHAWK	NOGO
NORTHERN HARRIER	NOHA
NORTHERN MOCKINGBIRD	NOMO
NORTHERN PARULA	NOPA
NORTHERN ROUGH-WINGED SWALLOW	NRWS
NORTHERN SAW-WHET OWL	NSWO
NORTHERN WATERTHRUSH	NOWA
OLIVE-SIDED FLYCATCHER	OSFL

COMMON NAME	CODE
ORCHARD ORIOLE	OROR
OVENBIRD	OVEN
PHILADELPHIA VIREO	PHVI
PILEATED WOODPECKER	PIWO
PINE SISKIN	PISI
PINE WARBLER	PIWA
PRAIRIE WARBLER	PRAW
PROTHONOTARY WARBLER	PROW
PURPLE FINCH	PUFI
PURPLE MARTIN	PUMA
RED CROSSBILL	RECR
RED SQUIRREL	RESQ
RED-BELLIED WOODPECKER	RBWO
RED-BREASTED NUTHATCH	RBNU
RED-EYED VIREO	REVI
RED-HEADED WOODPECKER	RHWO
RED-SHOULDERED HAWK	RSHA
RED-TAILED HAWK	RTHA
RED-WINGED BLACKBIRD	RWBL
ROSE-BREASTED GROSBEAK	RBGR
RUBY-CROWNED KINGLET	RCKI
RUBY-THROATED HUMMINGBIRD	RTHU
RUFFED GROUSE	RUGR
RUSTY BLACKBIRD	RUBL
SAVANNAH SPARROW	SAVS
SCARLET TANAGER	SCTA
SEDGE WREN	SEWR
SHARP-SHINNED HAWK	SSHA
SLATE-COLORED JUNCO	SCJU
SOLITARY VIREO	SOVI
SONG SPARROW	SOSP
SWAINSON'S THRUSH	SWTH
SWAMP SPARROW	SWSP
TENNESSEE WARBLER	TEWA
THREE-TOED WOODPECKER	TTWO
TREE SWALLOW	TRES
TURKEY VULTURE	TUVU
VEERY	VEER
VESPER SPARROW	VESP
WARBLING VIREO	WAVI
WHIP-POOR-WILL	WPWI
WHITE-BREASTED NUTHATCH	WBNU
WHITE-THROATED SPARROW	WTSP
WHITE-WINGED CROSSBILL	WWCR
WILD TURKEY	WITU
WILLOW FLYCATCHER	WIFL
WILSON'S WARBLER	WIWA

COMMON NAME	CODE
WINTER WREN	WIWR
WOOD THRUSH	WOTH
WORM-EATING WARBLER	WEWA
YELLOW PALM WARBLER	YPWA
YELLOW WARBLER	YWAR
YELLOW-BELLIED FLYCATCHER	YBFL
YELLOW-BELLIED SAPSUCKER	YBSA
YELLOW-BILLED CUCKOO	YBCU
YELLOW-SHAFTED FLICKER	YSFL
YELLOW-THROATED VIREO	YTVI

Appendix I. List of potential species for each NETN park/BCR and their PIF Continental and/or Regional Importance Rank, and Conservation Action Priority (PIF Species Assessment Database, www.rmbo.org/pif/pifdb). Species in boldface are those of conservation concern in one or more BCR.

		PIF Continental and/or Regional Importance[1]								PIF
		BCR[2] 28	BCR 30		BCR 13		BCR 14			Action
Common Name	Scientific Name	MORR	WEFA	MIMA	ROVA	SARA	MABI	SAGA	ACAD	Priority[3]
Mourning Dove	*Zenaida macroura*	X	X	X	X	X	X	X	X	
Black-billed Cuckoo	***Coccyzus erythropthalmus***	**RC**	**RC**	**RC**	**RC, RS**	**RC, RS**	**RC**	**RC**	**RC**	II
Yellow-billed Cuckoo	*Coccyzus americanus*	X	X	X	X	X	X	X		
Chimney Swift	***Chaetura pelagica***	**RC, RS**	**RC**	**RC**	X	X	X	X	X	II
Ruby-throated Hummingbird	*Archilochus colubris*	X	X	X	X	X	X	X	X	
Belted Kingfisher	***Ceryle alcyon***	**RC, RS**	X	X	**RC**	**RC**	**RC**	**RC**	**RC**	II
Red-headed Woodpecker	***Melanerpes erythrocephalus***	**CC, RC**			**CC, RC**	**CC, RC**				I
Red-bellied Woodpecker	*Melanerpes carolinus*	X	X	X	X	X				
Northern Flicker	***Colaptes auratus***	**RC**	**RC**	**RC**	**RC**	**RC**	X	X	X	II
Yellow-bellied Sapsucker	***Sphyrapicus varius***	X	X	X	X	X	**CS, RS**	**CS, RS**	**CS, RS**	III
Downy Woodpecker	***Picoides pubescens***	**RS**	X	X	X	X	X	X	X	III
Hairy Woodpecker	*Picoides villosus*	X	X	X	X	X	X	X	X	
Black-backed Woodpecker	*Picoides arcticus*								X	
Pileated Woodpecker	*Dryocopus pileatus*	X	X	X	X	X	X	X	X	
Eastern Wood Pewee	***Contopus virens***	**RC**	**RC**	**RC**	**RC**	**RC**	X	X	X	II
Olive-sided Flycatcher	***Contopus borealis***					X	**CC, RC**	**CC, RC**	**CC, RC**	II
Least Flycatcher	*Empidonax minimus*	X	X	X	X	X	X	X	X	
Acadian Flycatcher	***Empidonax virescens***	**RC, CS, RS**	X	X	X					II
Alder Flycatcher	*Empidonax alnorum*				X	X	X	X	X	
Willow Flycatcher	***Empidonax traillii***	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	III
Yellow-bellied Flycatcher	*Empidonax flaviventris*								X	
Eastern Phoebe	*Sayornis phoebe*	X	X	X	X	X	X	X	X	
Great Crested Flycatcher	*Miarchus crinitus*	X	X	X	X	X	X	X	X	
Eastern Kingbird	***Tyrannus tyrannus***	X	**RC**	**RC**	**RC**	**RC**	X	X	X	II
White-eyed Vireo	*Vireo griseus*	X	X							
Yellow-throated Vireo	***Vireo flavifrons***	**RC, CS, RS**	X	X	X	X		**RC**		II
Blue-headed Vireo	***Vireo solitarius***	X	X	X	X	X	**CS**	**CS**	**CS**	III
Warbling Vireo	*Vireo gilvus*	X	X	X	X	X	X	X	X	
Red-eyed Vireo	*Vireo olivaceus*	X	X	X	X	X	X	X	X	

Common Name	Scientific Name	PIF Continental and/or Regional Importance[1]								PIF Action Priority[3]
		BCR[2] 28	BCR 30		BCR 13		BCR 14			
		MORR	WEFA	MIMA	ROVA	SARA	MABI	SAGA	ACAD	
Philadelphia Vireo	*Vireo philadelphicus*								X	
Blue Jay	*Cyanocitta cristata*	X	X	X	X	X	X	X	X	
Gray Jay	*Perisoreus canadensis*								X	
Tree Swallow	***Tachycineta bicolor***	X	X	X	X	X	**RS**	**RS**	**RS**	III
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	X	X	X	X	X	X	X		
Bank Swallow	*Riparia riparia*	X	X	X	X	X	X	X	X	
Cliff Swallow	*Hirundo pyrrhonota*	X	X	X	X	X	X	X	X	
Barn Swallow	*Hirundo rustica*	X	X	X	X	X	X	X	X	
Black-capped Chickadee	*Poecile atricapillus*	X	X	X	X	X	X	X	X	
Carolina Chickadee	***Poecile carolinensis***	**RS**								III
Boreal Chickadee	***Poecile hudsonicus***								**RC**	II
Eastern Tufted Titmouse	*Baeolophus bicolor*	X	X	X	X	X	X	X		
Red-breasted Nuthatch	*Sitta canadensis*	X	X	X	X	X	X	X	X	
White-breasted Nuthatch	*Sitta carolinensis*	X	X	X	X	X	X	X	X	
Brown Creeper	*Certhia americana*	X	X	X	X	X	X	X	X	
House Wren	*Troglodytes aedon*	X	X	X	X	X	X	X	X	
Winter Wren	*Troglodytes troglodytes*		X	X	X	X	X	X	X	
Carolina Wren	*Thryothorus ludovicianus*	X	X	X	X					
Sedge Wren	*Cistothorus platensis*					X				
Golden-crowned Kinglet	*Regulus satrapa*					X	X	X	X	
Ruby-crowned Kinglet	*Regulus calendula*								X	
Blue-gray Gnatcatcher	*Polioptila caerulea*	X	X	X	X			X		
Eastern Bluebird	*Sialia sialis*	X	X	X	X	X	X	X	X	
Veery	***Catharus fuscescens***	X	**RC**	**RC**	X	X	**RS**	**RS**	**RS**	III-14 II-30
Swainson's Thrush	*Catharus ustulatus*					X	X	X	X	
Hermit Thrush	*Catharus guttatus*	X	X	X	X	X	X	X	X	
Wood Thrush	***Hylocichla mustelina***	**CC, RC, CS, RS**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	II
American Robin	*Turdus migratorius*	X	X	X	X	X	X	X	X	
Gray Catbird	*Dumetella carolinensis*	X	X	X	X	X	X	X	X	
Northern Mockingbird	*Mimus polyglottus*	X	X	X	X	X		X		
Brown Thrasher	***Toxostoma rufum***	**RC**	**RC**	**RC**	**RC**	**RC**	X	X	X	II
European Starling	*Sternus vulgaris*	X	X	X	X	X	X	X	X	
Cedar Waxwing	*Bombycilla cedrorum*	X	X	X	X	X	X	X	X	

		PIF Continental and/or Regional Importance[1]								PIF Action Priority[3]
		BCR[2] 28	BCR 30		BCR 13		BCR 14			
Common Name	Scientific Name	MORR	WEFA	MIMA	ROVA	SARA	MABI	SAGA	ACAD	
Blue-winged Warbler	***Vermivora pinus***	**CC, CS, RS**	**CC, RC, CS, RS**	**CC, RC, CS, RS**	X	X				III-28 II-30
Golden-winged Warbler	***Vermivora chrysoptera***	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**				I-28 II-30,13
Tennessee Warbler	*Vermivora peregrina*								X	
Nashville Warbler	*Vermivora ruficapilla*				X	X	X	X	X	
Northern Parula	***Parula americana***						**RS**	**RS**	**RS**	III
Yellow Warbler	*Dendroica petechia*	X	X	X	X	X	X	X	X	
Chestnut-sided Warbler	*Dendroica pensylvanica*	X	X	X	X	X	X	X	X	
Cape May Warbler	*Dendroica tigrina*								X	
Magnolia Warbler	***Dendroica magnolia***					X	**CS**	**CS**	**CS**	III
Black-throated Blue Warbler	***Dendroica caerulescens***					X	**RS**	**RS**	**RS**	III
Yellow-rumped Warbler	*Dendroica coronata*						X	X	X	
Black-throated Green Warbler	***Dendroica virens***					X	**CS, RS**	**CS, RS**	**CS, RS**	III
Blackburnian Warbler	***Dendroica fusca***						**CS, RS**	**CS, RS**	**CS, RS**	III
Prairie Warbler	***Dendroica discolor***	**CC, RC**	**CC, RC**	**CC, RC**	**CC**	**CC**				II-28, 30 III-13
Bay-breasted Warbler	***Dendroica castenea***								**CC**	III
Pine Warbler	*Dendroica pinus*			X			X	X	X	
Palm Warbler	*Dendroica palmarum*								X	
Blackpoll Warbler	***Dendroica striata***								**RC**	II
Cerulean Warbler	***Dendroica cerulea***	**CC, RC, CS, RS**			**CC, RC**	**CC, RC**				I-28 II-13
Black-and-White Warbler	***Mniotilta varia***	**RC**	**RC**	**RC**	X	X	**RS**	**RS**	**RS**	II-28, 30 III-14
American Redstart	***Setophaga ruticilla***	X	X	X	X	X	**RS**	**RS**	**RS**	III
Worm-eating Warbler	***Helmitheros vermivorum***	**CC, RC, CS, RS**	X		X					II
Ovenbird	*Seiurus aurocapillus*	X	X	X	X	X	X	X	X	
Northern Waterthrush	*Seiurus noveboracensis*					X	X	X	X	
Louisiana Waterthrush	***Seiurus motacilla***	**RC, CS, RS**	X		X	X	X	X		II
Kentucky Warbler	***Oporornis formosus***	**CC, RC, CS, RS**								II
Mourning Warbler	*Oporornis philadelphia*						X			

Common Name	Scientific Name	PIF Continental and/or Regional Importance[1]								PIF Action Priority[3]
		BCR[2] 28	BCR 30		BCR 13		BCR 14			
		MORR	WEFA	MIMA	ROVA	SARA	MABI	SAGA	ACAD	
Common Yellowthroat	*Geothlypis trichas*	X	X	X	X	X	X	X	X	
Wilson's Warbler	*Wilsonia pusilla*								X	
Hooded Warbler	***Wilsonia citrina***	**CS, RS**	**RC**							II-30 III-28
Canada Warbler	***Wilsonia canadensis***			X	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	II
Yellow-breasted Chat	***Icteria virens***	**RC**	X							II
Scarlet Tanager	***Piranga olivacea***	**RS**	**RC**	**RC**	X	X	X	X	X	II-30 III-28
Eastern Towhee	***Pipilo erythrophthalmus***	**RC, CS, RS**	**RC**	**RC**	**RC**	**RC**	**RC**	**RC**	**RC**	II
Chipping Sparrow	*Spizella passerina*	X	X	X	X	X	X	X	X	
Field Sparrow	***Spizella pusilla***	**RC**	**RC**	**RC**	**RC**	**RC**	X	X	X	II
Vesper Sparrow	*Pooecetes gramineus*					X				
Savannah Sparrow	***Passerculus sandwichensis***				**RC**	**RC**				II
Grasshopper Sparrow	*Ammodramus savannarum*					X				
Henslow's Sparrow	***Ammodramus henslowii***	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**	**CC, RC**				I
Nelson's Sharp-tailed Sparrow	***Ammodramus nelsoni***								**CC**	III
Song Sparrow	*Melospiza melodia*	X	X	X	X	X	X	X	X	
Lincoln's Sparrow	*Melospiza lincolnii*								X	
Swamp Sparrow	*Melospiza georgiana*	X	X	X	X	X	X	X	X	
White-throated Sparrow	***Zonotrichia albicollis***						**CS, RS**	**CS, RS**	**CS, RS**	III
Dark-eyed Junco	*Junco hyemalis*					X	X	X	X	
Northern Cardinal	*Cardinalis cardinalis*	X	X	X	X	X	X	X	X	
Rose-breasted Grosbeak	***Pheucticus ludovicianus***	X	**RC**	**RC**	**RS**	**RS**	X	X	X	II-30 III-13
Indigo Bunting	***Passerina cyanea***	**CS, RS**	X	X	X	X	X	X	X	III
Bobolink	***Dolichonyx oryzivorus***				**RC, RS**	**RC, RS**	**RC, RS**	**RC, RS**	**RC, RS**	II
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X	X	X	X	X	X	
Eastern Meadowlark	***Sturnella magna***				**RC**	**RC**				II
Common Grackle	*Quiscalus quiscula*	X	X	X	X	X	X	X	X	
Brown-headed Cowbird	*Molothrus ater*	X	X	X	X	X	X	X	X	
Orchard Oriole	*Icterus spurius*	X	X							
Baltimore Oriole	***Icterus galbula***	X	**RC, RS**	**RC, RS**	**RC, RS**	**RC, RS**	X	X	X	II
Purple Finch	***Carpodacus purpureus***		**RC**	**RC**	X	X	**RS**	**RS**	**RS**	II-30 III-14

Common Name	Scientific Name	PIF Continental and/or Regional Importance[1]								PIF Action Priority[3]
		BCR[2] 28	BCR 30		BCR 13		BCR 14			
		MORR	WEFA	MIMA	ROVA	SARA	MABI	SAGA	ACAD	
House Finch	*Carpodacus mexicanus*	X	X	X	X	X	X	X	X	
Red Crossbill	*Loxia curvirostra*						X	X	X	
White-winged Crossbill	*Loxia leucoptera*						X	X	X	
Pine Siskin	*Carduelis pinus*						X	X	X	
American Goldfinch	*Carduelis tristis*	X	X	X	X	X	X	X	X	
Evening Grosbeak	***Coccothraustes vespertinus***						**RS**	**RS**	**RS**	III
House Sparrow	Passer domesticus	X	X	X	X	X	X	X	X	

[1] X – Species may be present but not of conservation concern;
CC – Continental Concern Watch List Species are those which are most vulnerable at the continental scale;
CS – Continental Stewardship Species are those which a given BCR has a high responsibility for, and which have a large proportion of their global range within the BCR;
RC – Regional Concern Species are those which are vulnerable within the region or BCR;
RS – Regional Stewardship Species are those for which a given BCR has a high responsibility.

[2] BCR (Bird Conservation Region):
28 – Appalachian Mountains
30 – Southern New England/Mid-Atlantic Coast
13 – Lower Great Lakes/St. Lawrence Plain
14 – Atlantic Northern Forest

[3] Action Priority Codes:
I – Immediate conservation action is needed to reverse or stabilize significant, long-term population declines;
II – Management or other on-the-ground conservation actions are needed;
III – Long-term planning actions are needed to ensure that sustainable populations are maintained.

Appendix II. Species assignments in the 12 response guilds included in the biotic integrity scorecard. Species listed alphabetically within each guild.

Integrity Element	Response Guild	Species
Functional	Omnivore	American Crow American Goldfinch American Robin Baltimore Oriole Blue Jay Bobolink Brown Thrasher Brown-headed Cowbird Chipping Sparrow Common Grackle Common Raven Dark-eyed Junco Eastern Bluebird Eastern Meadowlark Eastern Towhee European Starling Evening Grosbeak Field Sparrow Fish Crow Grasshopper Sparrow Gray Catbird Gray Jay Henslow's Sparrow Indigo Bunting Lincoln's Sparrow Nelson's Sharp-tailed Sparrow Northern Cardinal Northern Mockingbird Orchard Oriole Pine Siskin Red-winged Blackbird Rock Dove Rose-breasted Grosbeak Ruby-throated Hummingbird Savannah Sparrow Song Sparrow Swainson's Thrush Swamp Sparrow Veery Vesper Sparrow White-throated Sparrow Wood Thrush Yellow-bellied Sapsucker

Integrity Element	Response Guild	Species
	Omnivore (cont.)	Yellow-breasted Chat
	Bark Prober	Black-and-White Warbler Black-backed Woodpecker Brown Creeper Downy Woodpecker Hairy Woodpecker Pileated Woodpecker Pine Warbler Red-bellied Woodpecker Red-breasted Nuthatch Red-headed Woodpecker White-breasted Nuthatch
	Ground Gleaner	Hermit Thrush Kentucky Warbler Mourning Warbler Northern Flicker Ovenbird Winter Wren Worm-eating Warbler
	Shrub Gleaner	American Redstart Black-billed Cuckoo Black-capped Chickadee Blackpoll Warbler Black-throated Blue Warbler Blue-headed Vireo Blue-winged Warbler Boreal Chickadee Canada Warbler Carolina Chickadee Carolina Wren Chestnut-sided Warbler Common Yellowthroat Eastern Tufted Titmouse Golden-crowned Kinglet Golden-winged Warbler Hooded Warbler House Wren Magnolia Warbler Nashville Warbler Palm Warbler Prairie Warbler Ruby-crowned Kinglet White-eyed Vireo Wilson's Warbler Yellow Warbler

Integrity Element	**Response Guild**	**Species**
	Shrub Gleaner (cont.)	Yellow-billed Cuckoo
		Yellow-rumped Warbler
	Canopy Forager	Bay-breasted Warbler
		Blackburnian Warbler
		Black-throated Green Warbler
		Blue-gray Gnatcatcher
		Cape May Warbler
		Cerulean Warbler
		Northern Parula
		Philadelphia Vireo
		Red Crossbill
		Red-eyed Vireo
		Scarlet Tanager
		Tennessee Warbler
		Warbling Vireo
		Yellow-throated Vireo
Compositional	Nest Predator/ Brood Parasite	American Crow
		Blue Jay
		Brown-headed Cowbird
		Common Raven
		European Starling
		Fish Crow
		Gray Jay
	Resident	American Crow
		American Goldfinch
		American Robin
		Black-backed Woodpecker
		Black-capped Chickadee
		Blue Jay
		Boreal Chickadee
		Brown Creeper
		Carolina Chickadee
		Carolina Wren
		Cedar Waxwing
		Common Raven
		Downy Woodpecker
		Eastern Bluebird
		Eastern Tufted Titmouse
		European Starling
		Evening Grosbeak
		Fish Crow
		Gray Jay
		Hairy Woodpecker
		House Finch
		House Sparrow

Integrity Element	Response Guild	Species
	Resident (cont.)	Mourning Dove Northern Cardinal Northern Flicker Northern Mockingbird Pileated Woodpecker Pine Siskin Purple Finch Red Crossbill Red-bellied Woodpecker Red-breasted Nuthatch Rock Dove White-breasted Nuthatch White-winged Crossbill
	Temperate Migrant	Bank Swallow Blue-gray Gnatcatcher Blue-headed Vireo Brown Thrasher Brown-headed Cowbird Chipping Sparrow Common Grackle Common Yellowthroat Dark-eyed Junco Eastern Meadowlark Eastern Phoebe Eastern Towhee Field Sparrow Golden-crowned Kinglet Grasshopper Sparrow Gray Catbird Henslow's Sparrow Hermit Thrush House Wren Lincoln's Sparrow Nelson's Sharp-tailed Sparrow Northern Rough-winged Swallow Pine Warbler Red-headed Woodpecker Red-winged Blackbird Savannah Sparrow Song Sparrow Swamp Sparrow Tree Swallow Vesper Sparrow White-eyed Vireo White-throated Sparrow

Integrity Element	Response Guild	Species
	Temperate Migrant (cont.)	Winter Wren Yellow-bellied Sapsucker Yellow-rumped Warbler
	Single Brooded	American Crow American Goldfinch Acadian Flycatcher Alder Flycatcher American Redstart Baltimore Oriole Bank Swallow Barn Swallow Bay-breasted Warbler Black-capped Chickadee Black-and-White Warbler Blackburnian Warbler Blackpoll Warbler Black-throated Blue Warbler Black-throated Green Warbler Blue-gray Gnatcatcher Blue-headed Vireo Blue-winged Warbler Bobolink Boreal Chickadee Brown Creeper Canada Warbler Cape May Warbler Carolina Chickadee Cedar Waxwing Cerulean Warbler Chestnut-sided Warbler Chimney Swift Cliff Swallow Common Raven Eastern Kingbird Eastern Tufted Titmouse Eastern Wood Pewee Fish Crow Golden-winged Warbler Great Crested Flycatcher Hooded Warbler Kentucky Warbler Least Flycatcher Louisiana Waterthrush Magnolia Warbler Mourning Warbler

Integrity Element	Response Guild	Species
	Single Brooded (cont.)	Nashville Warbler Northern Parula Northern Rough-winged Swallow Northern Waterthrush Olive-sided Flycatcher Orchard Oriole Ovenbird Palm Warbler Philadelphia Vireo Pine Siskin Pine Warbler Prairie Warbler Red-breasted Nuthatch Red-eyed Vireo Rose-breasted Grosbeak Scarlet Tanager Swainson's Thrush Tennessee Warbler Tree Swallow Veery Warbling Vireo White-breasted Nuthatch White-eyed Vireo Willow Flycatcher Wilson's Warbler Winter Wren Worm-eating Warbler Yellow Warbler Yellow-bellied Flycatcher Yellow-throated Vireo
	Exotic	European Starling House Finch House Sparrow Rock Dove
Structural	Forest Generalist	Black-billed Cuckoo Black-capped Chickadee Blue Jay Blue-gray Gnatcatcher Boreal Chickadee Carolina Chickadee Carolina Wren Dark-eyed Junco Downy Woodpecker Eastern Phoebe Eastern Towhee

Integrity Element	Response Guild	Species
	Forest Generalist (cont.)	Eastern Tufted Titmouse Eastern Wood Pewee Gray Catbird Gray Jay Great Crested Flycatcher Northern Cardinal Northern Flicker Northern Parula Philadelphia Vireo Purple Finch Red-bellied Woodpecker Red-eyed Vireo Rose-breasted Grosbeak White-eyed Vireo Wood Thrush Yellow-bellied Sapsucker Yellow-billed Cuckoo Yellow-throated Vireo
	Interior Forest Obligate	Acadian Flycatcher American Redstart Black-and-White Warbler Black-backed Woodpecker Blackburnian Warbler Blackpoll Warbler Black-throated Blue Warbler Black-throated Green Warbler Blue-headed Vireo Brown Creeper Canada Warbler Cerulean Warbler Golden-crowned Kinglet Hairy Woodpecker Hermit Thrush Hooded Warbler Kentucky Warbler Louisiana Waterthrush Magnolia Warbler Northern Waterthrush Olive-sided Flycatcher Ovenbird Pileated Woodpecker Pine Warbler Red Crossbill Red-breasted Nuthatch Ruby-crowned Kinglet

Integrity Element	Response Guild	Species
	Interior Forest Obligate (cont.)	Scarlet Tanager Swainson's Thrush Veery White-breasted Nuthatch White-winged Crossbill Winter Wren Worm-eating Warbler Yellow-bellied Flycatcher